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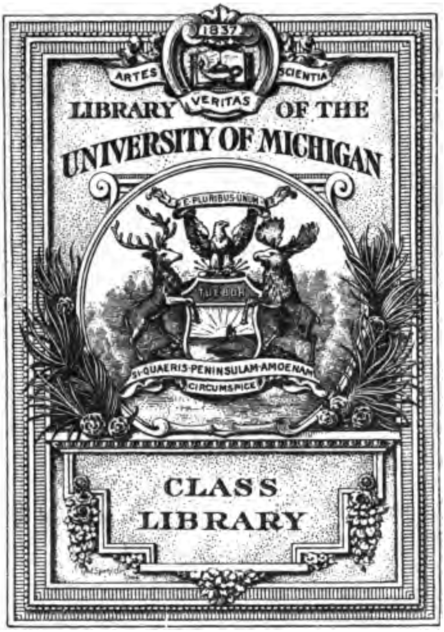

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STATE OF INDIANA

TENTH ANNUAL REPORT

OF THE

Indiana

State Board of Forestry

1910

CHAS. C. DEAM, Secretary

To the Governor

INDIANAPOLIS:
WM. B. BURFORD, CONTRACTOR FOR STATE PRINTING AND BINDING
1911

THE STATE OF INDIANA,
Executive Department,
December 1, 1910.

Received by the Governor, examined and referred to the Auditor of State for verification of the financial statement.

Office of Auditor of State,
Indianapolis, December 2, 1910.

The within report, so far as the same relates to moneys drawn from the State Treasury, has been examined and found correct.

W. H. O'BRIEN,
Auditor of State.

December 2, 1910.

Returned by the Auditor of State, with above certificate, and transmitted to Secretary of State for publication, upon the order of the Board of Commissioners of Public Printing and Binding.

MARK THISTLETHWAITE,
Secretary to the Governor.

Filed in the office of the Secretary of State of the State of Indiana, December 2, 1910.

L. G. ELLINGHAM,
Secretary of State.

Received the within report and delivered to the printer December 6, 1910.

A. E. BUTLER,
Clerk Printing Board.

C 5325

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Financial Statement.

OCTOBER 1, 1909, TO OCTOBER 1, 1910.

Annual Appropriation by the General Assembly, 1909.

1. Office—		
Salary of secretary of board	$1,800 00	
Salary of stenographer to secretary	600 00	
Salary of four board members	400 00	
Mileage of four board members	75 11	
General office expense and mileage	1,000 00	
Total		$3,875 11
2. Forest Reservation and Experimental Station	$3,000 00	

Expenditures.

Office—Salary:		
Chas. C. Deam, secretary of board	$1,800 00	
Nora M. Slattery, stenographer to secretary	600 00	
Samuel Burkholder, board member	99 96	
Samuel Burkholder, board member, mileage	15 91	
Stanley Coulter, board member	99 96	
Stanley Coulter, board member, mileage	13 80	
Arthur S. Nowels, board member	99 96	
Arthur S. Nowels, board member, mileage	26 32	
William W. Waltman, board member	99 96	
William W. Waltman, board member, mileage	19 08	
Total		$2,874 95

Office—General Expense:		
Office supplies	$310 36	
Postage	290 00	
Mileage	135 35	
Hotel	79 95	
Livery	78 90	
Telephone	42 50	
Photographic supplies	33 70	
Surveying	25 00	
Express	3 15	
Freight	1 09	
Total		$1,000 00

Reservation Expenses:

Labor	$2,048 35	
Forest cleaning	161 56	
Household supplies, hardware and tools	261 67	
Hay and corn	220 50	
Seedlings and seed	59 85	
Construction material	50 57	
Sawmill work, filing tools, etc	30 88	
Board for board members and surveyors	28 25	
Freight	28 12	
Telephone and repairing	26 90	
Carbide	22 20	
Blacksmithing	14 90	
Paints, oils and brushes	41 45	
Livery	3 00	
Express	1 10	
Total		$2,999 30

Receipts from sales at Forest Reservation and Experimental Station and remitted to State Treasurer upon recommendation of State Auditor $43 38

Introduction.

The interest in forestry in Indiana is rapidly increasing as is evidenced by an increased number of inquiries on forestry subjects from all classes of people. Progress is dependent on education, and rapid advancement may be expected since the public schools are devoting more time to the study of this important subject. The great number of requests from pupils and teachers for literature on forestry not only shows their interest, but the lack of suitable literature on the subject.

The study of forestry in the public schools must be supplemented by work that will create a healthy public sentiment with which to meet the present demands for forestry work, and which will give financial support.

Farmers are being aroused by increased competition and decreased soil fertility to a study of how to make their farms more remunerative. They are learning from high land values and high taxes that it is not profitable to have waste lands or neglected woodlots. Land owners who have waste, denuded or eroded land, or who have land too hilly to be farmed with profit, should receive instruction on forest planting and forest management, and not be left to the mercy of the importuning tree agent. It is believed that a liberal supply of our annual reports judiciously and economically distributed will accomplish much. Press bulletins will be issued again this year at frequent intervals, calling the attention to the profits and necessity for forest planting.

The appeal for forest conservation is timely and honest, and will receive the best efforts of the board to effect a speedy solution of the problem.

STATE BOARD OF FORESTRY.

Reservation.

By an act of the Legislature, March 3, 1903, the State Board of Forestry was empowered to purchase 2,000 acres of land "in any county or counties of the State for a forest reservation, laboratory of forestry demonstration and State nurseries, for a consideration not to exceed eight dollars per acre." The board, after considering thirty offers, decided to accept the one offered by Dunlevy and Freeman, of Henryville. The land purchased is located in the northwestern part of Clark County, bounded on the west and north by Scott County. It is situated just west of the Pennsylvania Railroad and the Indianapolis and Louisville electric line. The shape is that of an irregular oblong, about one mile wide north and south and three miles long east and west.

The surface is broken. About six hundred acres of the northwest part are located in the "knobstone shales," and are one hundred to four hundred feet higher than the east part. This knobstone area is traversed by several deep ravines, which forever unfit it for agriculture, and make it so inaccessible that the removal of the timber products is practically impossible. Only about thirty acres of this area was ever cleared, and it has not been cultivated since the State purchased it. It is now so thickly grown up, principally in sassafras, that in places one can only get through it with difficulty. The woodland part is thickly covered with trees, chestnut oak, and yellow pine predominating. Neither of these two trees grow to a great size on the "knobs" and many of them become doty at the base when they reach a diameter of a foot or more. In the lower and wider stretches of the ravines are found other species, indicative of a richer soil.

The east part of the reservation is somewhat hilly, although not abruptly broken. It is traversed by several ravines which drain to the southeast. The soil varies from a loose to a compact clay. About two hundred and seventy acres of this part had been cleared. Since the purchase one hundred and nine acres have been planted to forest. Twenty are at present under cultivation which will be planted to trees in 1911. The remainder of the cleared land has not been cultivated since the purchase and is now thickly grown up with briars, sassafras and various species of forest trees.

The annual appropriation for the maintenance of the forest experimental station is three thousand dollars. This amount covers the salaries of the custodian and teamster, and the expenses of light, fuel, horse feed, repairs, supplies, agricultural implements, planting, cultivating, pruning, etc. The custodian receives six hundred dollars per annum, the teamster five hundred and twenty dollars per annum, laborers one dollar and seventy-five cents per day of ten hours, and men with teams three dollars per day of ten hours.

Experimental Tracts.

The fact that it is not yet known which are the best species of forest trees to plant in Indiana, or how best to manage them, encourages the board to plant the cleared areas as fast as time and money will permit. Up to date there are twenty-eight tracts planted to forest, aggregating one hundred nine and nineteen hundredths acres, as determined by the survey of December, 1909. Through the courtesy of the Department of Civil Engineering of Purdue University, Messrs. William Schoenmetzler, Walter Schoenmetzler and Charles Miller were detailed to make the survey, which was done during the holiday week of 1909. The survey of the plantings on the east side of the reservation was begun at B. M. 270 in the line of the Illinois Grant dividing lots Nos. 270 and 283. The survey of the plantings in the middle of the reservation was begun at a stone at the southeast corner of the ten-acre tract formerly owned by Sarah Armstrong. Two or more of the corners of each tract has been marked with a concrete marker, thirty-six inches long and five by six inches square, placed twenty-four inches deep in the earth. One monument of each tract is centered in order to facilitate resurveys and to give a starting point for the survey of additional tracts. Tracings showing all the plantings are on exhibit at both the office and reservation. The outline of most of the tracts is very irregular, due in a great measure to carelessness in not straightening the boundaries when the planting was done.

The following table shows the number of tracts planted, their area, the species planted, date of planting, whether planted with seeds or seedlings, and spacing of trees. The numbers missing in the table are given to woodland areas and to tracts on which experiments in natural seed regeneration are being tried.

No.	Acres.	Species.	Date.	What Planted.	Spacing.
1	1.89	Ash	Fall 1904	Seed	5x5 ft.
2	2.38	Mixed oak	Fall 1904	Seed	5x5 ft.
3	2.98	Yellow poplar	Spring 1907	Seedlings	5x5 ft.
4	1.96	Black walnut	Fall 1905	Seed	5x5 ft.
5	6.69	Black walnut	Fall 1904	Seed	5x5 ft.
13	28.08	Mixed hardwood	Fall 1905	Seed	Broadcast.
16	5.64	Black walnut	Spring 1904	Seed	5x5 ft.
20	.18	Mixed hardwood	Fall 1904	Seed	Broadcast.
21	2.71	Catalpa and oak	Spring 1907	Seedlings	5x5 ft.
22	.27	Black locust	Spring 1907	Seedlings	4x4 ft.
23	.51	Catalpa and ash	Spring 1909	Seedlings	5x5 ft.
24	2.89	Black walnut	Fall 1097	Seed	4x4 ft.
26	1.71	Yellow poplar	Spring 1907	Seedlings	4x5 ft.
27	.62	Black locust	Spring 1907	Seedlings	4x5 ft.
28	9.92	Walnut and hickory	Spring 1910	Seed	16x16 ft.
29	.10	Chestnut	Fall 1904	Seed	4x4 ft.
30	.07	Pecan	Fall 1904	Seed	4x4 ft.
31	.60	Coffeenut	Fall 1906	Seedlings	4x5 ft.
32	.52	Black locust	Fall 1904	Seed	4x4 ft.
33	6.40	Catalpa	Spring 1910	Seedlings	8x8 ft.
34	3.79	Ash	Spring 1909	Seedlings	6x8 ft.
35	5.16	Ash	Spring 1909	Seedlings	6x7 ft.
36	4.11	Ash	Spring 1908	Seedlings	5x5 ft.
37	6.22	Ash and elm	Spring 1908	Seedlings	5x5 ft.
38	2.14	Ash and elm	Spring 1908	Seedlings	5x5 ft.
39	4.18	Mixed hardwood	Spring 1904	Seedlinvs	5x4½ ft.
40	2.53	Catalpa	Spring 1908	Seedlings	3x6 ft.
41	5.04	Catalpa, locust and yellow poplar	Spring 1908	Seedlings	5x5 ft.

The foregoing table shows there have been twenty-eight tracts planted, aggregating one hundred nine and nineteen hundredths acres.

Prior to the survey of 1909 no detailed account was kept of the items of expense incurred by the several tracts. Since this time an account has been opened up with each tract and every item of expense made in its management is charged to it.

A complete history of each tract cannot be given, since the office records of this kind begin with October, 1909. The cost of cultivation of 1910 may appear excessive, but this is due to the fact that the season was wet, which made it difficult to kill the grass and weeds, and because in many of the plantings during the previous year a blue grass sod had been permitted to form, which was hard to kill. All cultivation is now done with a double shovel, or two-horse cultivator. More care is now given to planting the trees in straighter rows, which greatly facilitates cultivation and reduces the cost of hoeing. When the trees are in crooked rows it is not possible to plow close to all of the trees, which leaves much more work for the hoe.

As the term is used in this report a cultivation means a plowing. When the trees are young and in rows five feet apart, it is necessary to plow between the rows three times. When they are four or five years old the plowing must be very shallow and only once or twice between the rows.

A hoeing means cutting down all the weeds, grass, shoots, sprouts, briars, etc., left by the plow.

A moderate pruning means cutting off very strong or large side branches and cutting off all but one of the terminal leaders.

In order to get a more detailed and comprehensive idea of the work that is being done, the following table is given, after which each planting will be treated separately.

Number of Tract.	Number of Acres.	Number of Times Hoed and Cultivated.	Cost of Hoeing and Cultivating.		Cost of Pruning.		Total Expense.
			Total.	One Acre Once.	Total.	Per Acre.	
1-A	.65	1	$ 2 13	$3 28	$ 4 05	$6 26	$ 6 18
1-B	1.24	1	1 90	1 53	3 45	2 78	5 35
2	2.38	4	13 25	1 39	1 50	63	14 75
3	2.98	4	21 88	1 83	3 60	1 21	25 48
4	1.96	5	11 07	1 14	4 90	2 50	15 97
5	6.69	5	34 15	1 02	2 85	43	37 00
13	28.08	......	......	......	30 88	1 10	30 88
16	5.64	3	30 05	1 78	4 50	80	34 55
20	.18	4	2 36	3 27	......	......	2 36
21	2 71	4	18 65	1 72	6 30	2 32	24 95
22	.27	1	35	1 30	2 40	8 89	2 75
23	.51	3	3 63	2 37	22	43	3 85
24	2.89	5	18 37	1 27	60	21	18 97
26	1.71	3	6 99	1 36	3 00	1 75	9 99
27	.62	3	5 87	3 15	1 50	2 42	7 37
28	9.92	4	30 73	80	......	......	30 73
29	.10	4	61	1 52	......	......	61
30	.07	4	63	2 26	08	1 14	71
31	.60	4	2 59	1 08	15	25	2 74
32	.52	1	45	87	1 80	......	2 25
33	6.40	4	21 40	84	......	......	21 40
34	3.79	4	19 18	1 30	......	......	19 18
35	5.16	4	39 53	1 91	......	......	39 53
36	4.11	4	25 55	1 56	1 80	44	27 35
37	6.22	4	40 07	1 61	......	......	40 07
38	2.14	4	14 60	1 70	......	......	14 60
39	4.18	4	23 06	1 38	......	......	23 06
40	2.53	4	18 51	1 82	75	30	19 26
41	5.04	4	19 44	96	1 05	20	20 49
Total..	109.20	......	$427 00	$1 22	$75 38	$1 06	$502 38

Average cost of hoeing and cultivating one acre once	$1 22
Average cost of pruning per acre	1 06

It will be noted that the average cost of cultivating Tracts No. 28 and 33, which were planted this year, was eighty and eighty-four cents per acre respectively. The higher price on the other tracts was due to the fact that some were small and some were neglected the preceding years.

TRACT No. 1.

"Tract No. 1 is an experiment of reforesting an open field to American ash from seed planting. This field was consecutively farmed for more than fifteen years and until all traces of forest humus was gone. The field was regularly prepared, as for corn planting, and seeds drilled thickly in rows during November, 1904

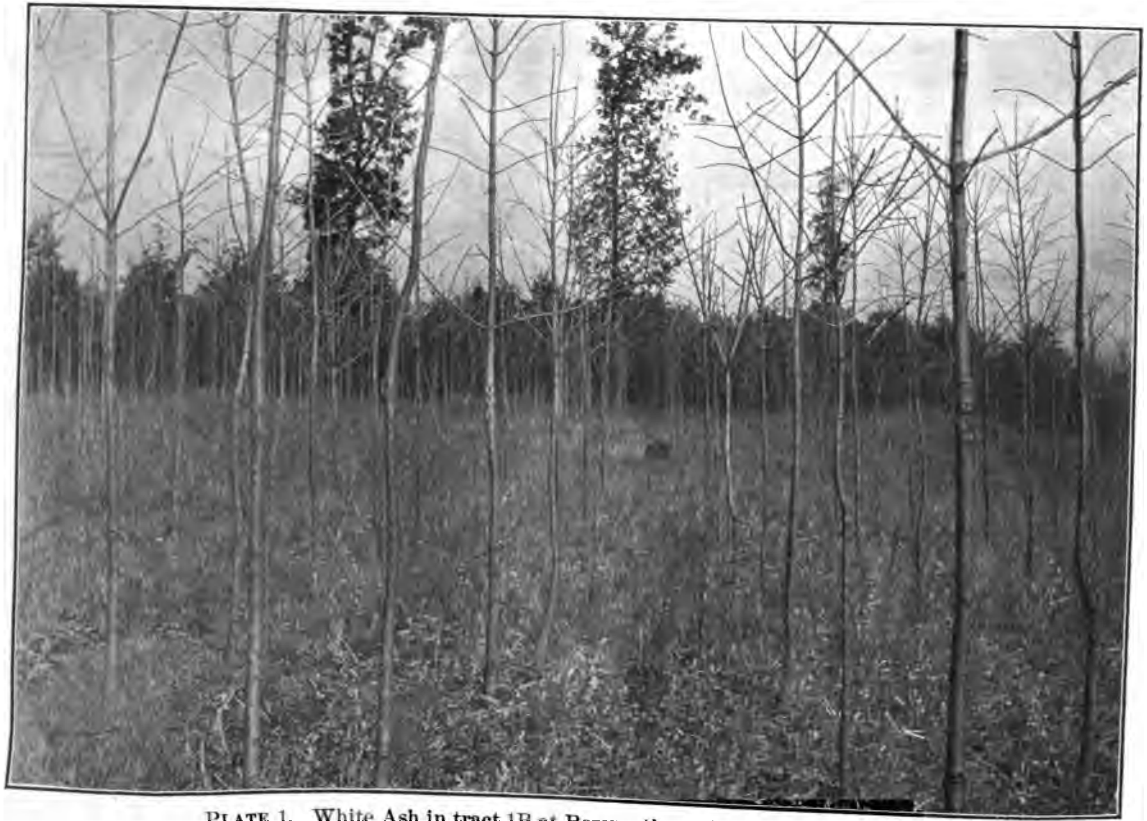


PLATE 1. White Ash in tract 1B at Reservation. Seed planted fall 1904.

(see Fourth Annual Report, 1904, page 16, planting 6). This planting was given but limited cultivation. The fall of 1906 all the seedlings were dug and transplanted to other fields, except the stand retained as shown by the tabulations, which were left to form a permanent forest stand."

"Soil loose, porous, sandy clay. Elevation, 590 feet. Approximate trees per acre, 1,720." (From Seventh Annual Report, page 86.) The surface is practically level, though gently sloping to the southeast.

The public road divides this tract east and west. The part south of the road is designated as 1-A, and contains sixty-five hundredths of an acre. The part north of the road is 1-B and contains one and twenty-four hundredths acres. In December all the trees in part 1-A that were too crooked to make straight trees were coppiced and the remainder were pruned to a switch. The total number of trees in tract 1-A was nine hundred and twenty, of which number 41 were coppiced. A severe windstorm on May 30th broke off 68 of the trees, which were afterward coppiced. So many of the pruned trees breaking off shows that the pruning was too severe. Out of a total of one hundred and nine trees coppiced, one hundred and three sprouted.

Part 1-B contains three thousand two hundred and nine trees. Ten rows on the east side were not pruned, in order to show the effect of no pruning. The remainder received a moderate pruning, except seventy-five trees which were coppiced because they were too crooked to make desirable trees. The windstorm of May 30th, which broke off sixty-eight trees in a total of eight hundred and seventy-nine in part 1-A, broke off only fourteen in a total of three thousand one hundred and thirty-four in part 1-B. The trees that were broken off were coppiced. The total number of trees coppiced in part 1-B was 89, 68 of which sprouted.

This is the oldest ash planting on the reservation. The trees show a rapid growth. See plate 1. To date neither fungus nor insect has injured it. Late this fall a great number of beetles (Xyloryctes satyrus Fab.) were found burrowing near the base of the trees. Probably thirty per cent. of the trees had burrows near the base. It remains to learn what damage this insect will do. Present results indicate that the white ash is one of the most desirable forest trees to plant in Indiana. It is easily managed, grows rapidly, is free from insect and fungous enemies and is easily and cheaply propagated either from seed or seedlings.

TRACT NO. 2.

"Plat No. 2 is an experiment at reforesting an old field to mixed oak by planting acorns. This field is the same as indicated in Tract No. 1, ash planting, and planted at the same time and in the same manner. The treatment is the same throughout for both plantings, and all the soil conditions are the same. Damping off was very great, and was even so the last summer. The results from transplanting oak seedlings are bad and indicate the oaks must be grown from seed planted where it is aimed for the tree to grow."

"The approximate trees per acre are 836, which is not at all discouraging for oak propagation on old fields. It must be remembered, however, that a small oak seedling six or eight inches high of stem may have a root from 3 to 5 feet long, and almost a load for a man to carry. They grow slowly and scrubby until the root foundation is established." (From Seventh Annual Report, page 88.)

The trees in this tract are in rows about four feet apart, with the trees about four feet apart in the rows. In the spring of 1908 the vacant spaces were planted with yellow poplar. The stand in the spring of 1910 was about 80 per cent.

The tract received a moderate pruning in January, 1910, and four cultivations during the season. Most of the trees in this tract are crooked, and it appears that in order to induce a straight growth it will be necessary to coppice many. Present results would indicate that in afforesting with oak the seed should be planted very thickly, averaging one to every square foot of ground, and that the seedlings be abandoned to the operation of the law of the "survival of the fittest."

TRACT NO. 3.

"Plat No. 3 is an experiment at reforesting an old field to tulip poplar by transplanting upon it seedlings of one year's growth and of 15 to 24 inches high. These seedlings were purchased in Tennessee from a locality having similar soil and characteristics to that of the area planted. They were secured in the fall of 1906 and stored over winter and planted early in April, 1907. At the time of planting a mule team and a plow were used to make a wide, deep furrow across the field. Men with armloads of trees followed and placed them, drawing dirt with their feet upon the roots to hold them in place, and then a mule and plow completed the covering by turning a furrow of dirt upon them from both sides. It became necessary to straighten up and arrange some of them after covering with the plow."

"The result of the work to date is almost perfect, as not 25 trees out of 20,000 planted in this field failed of growing this summer, and all indications point to their continuance. Soil porous, sandy and gravelly loose clay; 520 feet elevation and natural rolling drainage. Approximate trees per acre, 1,718." (From Seventh Annual Report, page 89.)

The tract has a southeastern slope with good surface drainage, the south boundary being a ravine. The soil is a yellowish white clay. The tract contains two and ninety-eight hundredths acres. In the spring of 1910 the stand of tulip poplar was three thousand eight hundred and eighty-two. The southeast part of the tract has been replanted with buckeye. The trees are planted in rows approximately five feet apart and four to five feet apart in the rows.

In December the trees received a moderate pruning; a hand pruning on June 11th and four cultivations and hoeings during the season.

This is the oldest yellow poplar planting on the reservation. The trees have made a rapid growth. Present results would suggest that yellow poplar is one of the best for afforestation purposes in Indiana.

TRACT No. 4.

"Plat No. 4 is an experiment at reforesting an old field with black walnut by planting the seed. This field was planted in the fall of 1905. (See Fifth Annual Report, page 20.) The missing places were filled in this last spring, 1907, by planting American ash seedlings. The soil and conditions are the same as given for plat No. 3."

"Approximate trees per acre, 1,774." (From Seventh Annual Report, page 90.)

This tract contains one and ninety-six hundredths acres. The surface slopes to the west. It is bounded on the west and south by a ravine.

In January, 1910, the tract was pruned. In order to demonstrate natural pruning, ten rows on the west side were not pruned. Four hundred and fifty-eight of the walnut and seventy-five of the ash trees were coppiced. The remainder received a moderate pruning. Of the four hundred and fifty-eight walnut trees coppiced, four hundred and fifty-two sprouted, and of the ash coppiced seventy-four sprouted. The tract was given five plowings and five hoeings during the season. The annual height growth in the planting for the past three years has averaged three to five feet. See plate 2. The greatest trouble with the walnut tree is the tendency

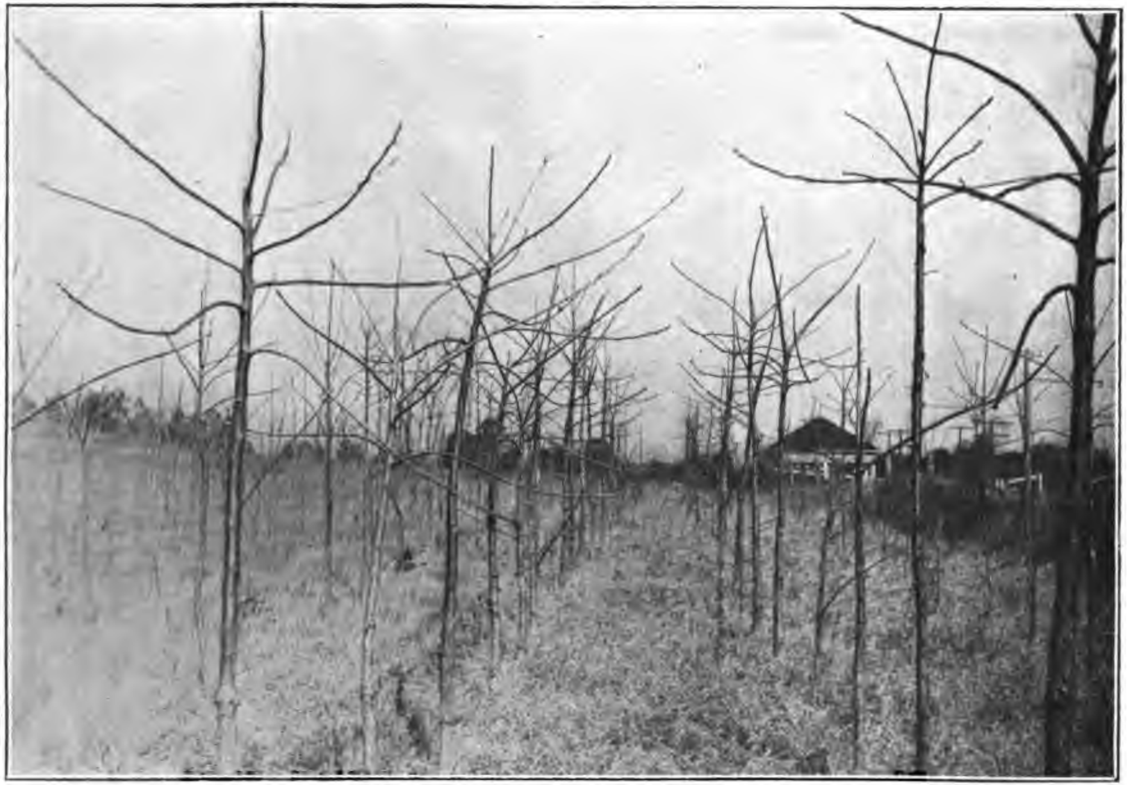


PLATE 2. Black Walnut in tract 4 at Reservation. Seed planted fall 1905.

to grow a large number of leaders. Apparently the best way to deal with such trees is to coppice them. The results at the reservation show that without doubt the black walnut is one of the best trees to plant in Indiana.

TRACT NO. 5.

"Tract No. 5 is an experiment planting for the same purpose as that of No. 4, and planted the fall of 1904, but on a field with different drainage and soil conditions. The soil of this field is less sandy, gravelly and porous and is low, level in drainage and consequently the trees have not done as well. Owing to the wet condition of the soil grass sod has formed and made cultivation more difficult and the growth of the trees has not been so good."

"Elevation 520 feet. Average trees per acre, 1,536." (From Seventh Annual Report, page 91.)

The area of this tract is six and sixty-nine hundredths acres. The trees are in rows approximately four by five feet. In the spring of 1910 the stand was ten thousand seven hundred and sixty-nine walnut trees. In January, 1910, all the straight trees of the tract received a moderate pruning. The remainder were left to be coppiced at a later date. The growth of the trees on this tract is very unequal. Many of the trees have died in the low places and it is only on the higher and looser ground that the trees do well.

This tract received five cultivations and five hoeings during the season.

TRACT NO. 13.

"Plat No. 13 is an experiment at reforesting a 40-acre field by mixed planting. This field is very good soil and has gently rolling surface. A variety of soils, however, is found throughout the tract. The hickory, walnut and oak stands were obtained by planting the seeds upon the field in the fall of 1905 and the transplanting of the ash and elm seedlings was done last fall, 1906, and this last spring, 1907. This stand will be enriched by other plantings and natural growth as time will permit."

"Elevation of this tract as a whole, 590 feet." (From Seventh Annual Report, page 102.)

The area of this tract is twenty-eight and eight hundredths acres. The surface is rolling, with good drainage toward a depression east of the center, which courses southeast. During January, 1910, all of the straight trees were given a moderate pruning and all of the bushy trees that were an inch or more in diameter were coppiced. The remainder received no attention. During the summer the briars, etc., were cut down with hoes.

TRACT NO. 16.

"Plat No. 16 is an experiment of a walnut planting at the base of the knoblands upon a field cultivated for several years, but not abandoned, and which possessed a soil composition of porous sandy and gravelly clay suited to walnut growth and upon which field stood several good thrifty walnut trees. This field was planted to walnut seeds the spring of 1904 at distances of five feet apart and was given two plowings as cultivation per season until the past summer, when they were not given any attention at all. This tract is surrounded on three sides by timbered land and consequently the squirrels disturbed the planting by digging up the walnuts and carrying them away. Thus the stand is not complete, but the acre given is the average for the tract of 6,000 trees in the planting which are growing at this time." (See Fourth Annual Report, 1904, page 12, Planting 1.)

"Elevation of this tract is 700 feet. Natural rolling surface drainage." (From Seventh Annual Report, page 105.)

The area of this tract is five and sixty-four hundredths acres. In March, 1910, the straight trees of the tract were given a moderate pruning. All trees an inch or more in diameter at the base, which did not give promise of making a straight bole, were coppiced. The remainder of the crooked trees were left to grow another year before coppicing. The total number of trees coppiced was three hundred and twenty-eight, of which number two hundred and forty-seven sprouted from the stump. The tract had become so foul with blue grass, briars, sassafras, etc., that it was decided to grub and cultivate it during the season of 1910. The tract was given three plowings and hoeings during the season. The growth averaged from one to three feet corresponding to the different types of soil and drainage of the tract.

TRACT NO. 20.

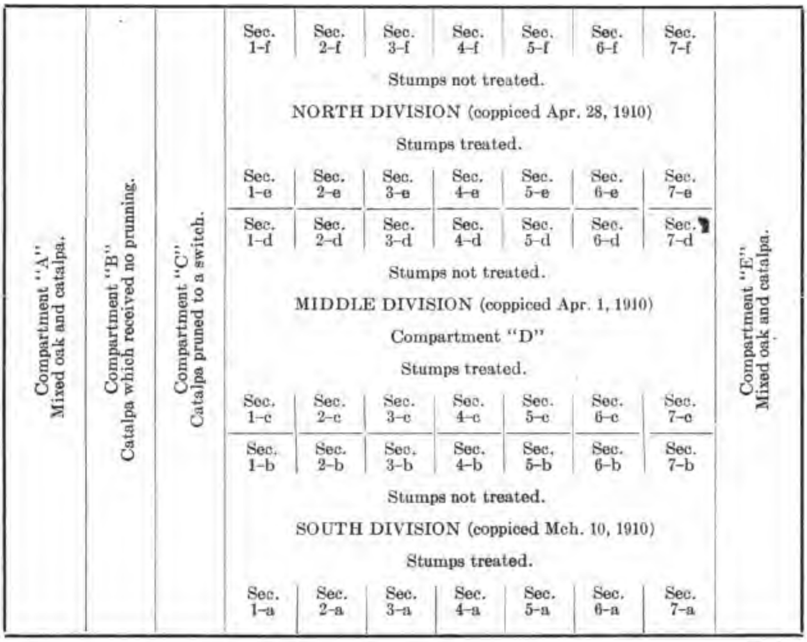
This tract contains eighteen hundredths of an acre. It appears that the tract was planted about 1904 or 1905 with oak seed. In the spring of 1908 it was replanted with seedlings of ash and catalpa. The trees are in rows about four feet apart, and about five feet apart in the rows. During the season the tract received four plowings and four hoeings.

TRACT NO. 21.

This tract contains two and seventy-one hundredths acres. The soil is a porous clay with good surface drainage. The greater part of this tract is a north exposure. Average elevation five hundred and ninety feet. The indications are that the whole of this tract was originally planted with oak seed; that the east side was planted with black oak which resulted in a fair stand; and that the remainder of the tract was planted with other species of oak which failed to germinate. After the oak failed to germinate it seems the whole of the tract was replanted with catalpa, which resulted in a pure stand of catalpa on the greater part of the tract.

In all parts of the tract an occasional ash is found, apparently of the same age as the catalpa. The trees were planted in rows extending up and down the hill, five feet apart at varying distances in the rows. In the spring of 1910 the trees were thinned until the trees stood approximately four feet apart in the rows. When the trees were thinned as many as twelve seedlings of catalpa were found in a hill. The catalpa trees in this tract show four years' growth and there are indications that they are C. bignonioides Walt. In the spring of 1910 the average growth for the treee years was about four or five feet. A majority of the trees were so scrubby that it was decided to demonstrate the effect of coppicing. Accordingly the tract was divided into five compartments, A, B, C, D and E. The first twenty rows on the west side of the tract was such a poor stand of catalpa that it was not considered in this experiment and is known as compartment '''A.'' Compartment ''B'' is composed of the next five rows of trees to the east, which were allowed to grow to demonstrate natural pruning. The next five rows to the east of ''B'' is compartment ''C'' and was pruned to a switch to show the effect of severe pruning. The next thirty-five rows to the east make up compartment ''D,'' which were coppiced. The remainder of the tract, which is principally oak, is compartment ''E'' and received a moderate pruning.

Compartment ''D'' was divided parallel to the other compartments into seven sections of five rows of trees each. Each row contained approximately forty catalpa trees. Beginning on the south side, six subsections of thirty trees each were made from each section, and designated as a, b, c, d, e and f. See schematic drawing for details.



SCHEMATIC DRAWING OF TRACT NO. 21.

Compartment "D" was divided north and south into seven sections of five rows each.
Compartment was again divided east and west into three divisions, south, middle and north.

In this compartment it was planned to demonstrate the effect of early and late coppicing; low and high stump; as well as to determine whether treating the green stump with an antiseptic has any value. The antiseptic used was a paint made of linseed oil and venetian red to which was added 3 per cent. of powdered copper sulphate.

The compartment was again divided east and west into three parts which are designated as "south," "middle" and "north" divisions. The "south" division is composed of the subsections a and b of each section and was coppiced March 10, 1910. The "middle" division is composed of the subsection c and d of each section, and was coppiced April 1, 1910. The "north" division is composed of the subsections e and f of each section, and was coppiced April 28, 1910. One-half of the number of stumps coppiced on each of the preceding dates was painted with the antiseptic paint. That is, subsections a, c and e were painted.

The trees were coppiced with a saw at an angle of about twenty-five degrees, with the highest part of the stump to the southwest.

All of the trees in section one were coppiced even with the ground. The trees in section two, one inch above the ground; section three, two inches above the ground; section four, three inches above the ground; section five, four inches above the ground; section six, five inches above the ground, and section seven, six inches above the ground.

In each division when the coppiced shoots were about one foot high, the number of shoots on each stump was counted and all were removed except the longest, the height of which was measured. The work was done on the "south" division May 25th, on the "middle" division June 9th, and on the "north" division June 13th, with the following tabulated results. Only the average for the several sections are given.

"SOUTH" Division.		"MIDDLE" Division.		"NORTH" Division.	
Av. Number of Shoots.	Av. Height of Sprouts.	Av. Number of Shoots.	Av. Height of Shoots.	Av. Number of Shoots.	Av. Height of Shoots.
1-a....3.8	13.7 inches.	1-c....3.7	14.6 inches.	1-e....4.6	16.9 inches.
1-b....4.6	12.4 inches.	1-d....3.5	16. inches.	1-f....5.	15.6 inches.
2-a....3.6	14.6 inches.	2-c....3.6	15.7 inches.	2-e....4.2	16.7 inches.
2-b....4.	12.5 inches.	2-d....4.	16. inches.	2-f....5.	15. inches.
3-a....4.5	13.3 inches.	3-c....3.8	15.8 inches.	3-e....4.3	13.3 inches.
3-b....4.6	12.7 inches.	3-d....4.4	15. inches.	3-f....4.	13.3 inches.
4-a....4.7	12.5 inches.	4-c....4.8	16.2 inches.	4-e....4.8	11.6 inches.
4-b....4.7	11.2 inches.	4-d ...4.5	15.4 inches.	4-f....4.2	12.5 inches.
5-a....5.5	12.7 inches.	5-c....5.	17.4 inches.	5-e....6.2	10. inches.
5-b....5.5	12.3 inches.	5-d....4.5	16. inches.	5-f....4.2	12.5 inches.
6-a....4.4	12.8 inches.	6-c....4.8	14. inches.	6-e....6.2	18. inches.
6-b....5.	12.6 inches.	6-d....4.6	18. inches.	6-f....9.7	13.9 inches.
7-a....4.4	11.6 inches.	7-c....6.	18.3 inches.	6-e....5.6	14.8 inches.
7-b....5.	10.8 inches.	7-d....5.6	14.6 inches.	7-f....6.2	12.7 inches.

At the end of the growing season, on November 5th, the height of all the sprouts was measured to determine what effect the time of coppicing and height of stump has on the total height growth for the season. The results tabulated are as follows:

"SOUTH" Division.		"MIDDLE" Division.		"NORTH" Division.	
Average Height, in inches.		Average Height, in inches.		Average Height, in inches.	
1-a....79.64	1-b....84.52	1-c....74.65	1-d....77.52	1-e....73.90	1-f....59.82
2-a....73.96	2-b....72.72	2-c....66.03	2-d....66.02	2-e....71.97	2-f....68.79
3-a....66.90	3-b....63.08	3-c....61.05	3-d....56.90	3-e....52.50	3-f....51.75
4-a....66.73	4-b....60.58	4-c....64.20	4-d....58.65	4-e....49.08	4-f....41.18
5-a....64.43	5-b....63.43	5-c....64.60	5-d....56.27	5-e....48.99	5-f....48.77
6-a....69.20	6-b....59.83	6-c....66.41	6-d....57.77	6-e....61.48	6-f....50.95
7-a....63.85	7-b....71.11	7-c....65.43	7-d....55.46	7-e....64.12	7-f....56.75
Average.69.24	67.90	66.05	61.23	60.29	54.00
Division Av..63.57		63.64		57.19	

The effect the antiseptic paint had on the number and height of the shoots was as follows:

Average number of shoots on all the treated stumps	4.7
Average number of shoots on all the untreated stumps	4.9
Average height of the shoots on the treated stumps	14.5
Average height of the shoots on the untreated stumps	13.7
Average total height of sprouts on treated stumps	65.19
Average total height of sprouts on untreated stumps	61.04

The effect the height of stump had on the number and height of sprouts was as follows:

	Number of shoots.	First Measurement.	Total height, inches.
Coppiced at 0	4.2	14.9	75.01
1 inch	4.1	15.1	69.91
2 inches	4.2	13.9	58.70
3 inches	4.6	13.2	56.74
4 inches	5.1	13.4	57.41
5 inches	5.8	14.9	60.91
6 inches	5.4	13.8	62.79

The effect the time of coppicing had on the number and height of the shoots was as follows:

	Number of shoots.	First Measurements.	Total height, inches.
March 10, 1910............	4.6	12.6	63.57
April 1, 1910.............	4.4	15.9	63.64
April 28, 1910............	5.3	14.1	57.19

The result of the experiment of coppicing was modified very much by the character of the soil and the drainage. The soil is not uniform in quality, and the north part of the north division, which is at the base of the hill, appears to be too wet to be favorable to catalpa. For the next three years it is planned to duplicate this experiment in a tract with uniform soil conditions, and it is expected to get uniform results.

Some of the more important facts demonstrated were: (1) That the trees should be coppiced low, about an inch above the ground. (2) That the shoot left should set close to the top of the stump, and that if possible one to the windward side should be selected. (3) That the superfluous shoots should be cut when the tallest is about one foot high, since by this time all of the shoots have started and their removal will permit the shoot that is left to grow a swelled base which will strengthen it at the point of attachment and thus reduce the danger of breaking off by the wind. Many planters prefer to permit all of the shoots to grow during the entire season and to remove the superfluous shoots after the year's growth has been completed. The idea is, that in permitting all of the shoots to grow there is a mutual protection against being torn or blown down by the wind. The error in this method of management is apparent when one considers the fact that many shoots have the same footing that the one selected shoot would have if all others were cut away. When all the shoots are permitted to grow, a large sprout will frequently have a support only an inch wide, which makes it a ready victim for the first windstorm. It is also to be noted that where a stump is found with one sprout broken down, that usually all of the sprouts are broken off, which leaves the stump in bad condition for future sprout growth.

TRACT NO. 22.

This is an experiment of planting black locust seedlings, four by four feet apart. The soil is a sandy clay with good surface drainage. Area twenty-seven hundredths of an acre. The tract consists of five rows of trees, approximately one hundred and ten trees to the row. The trees show four years growth. Prior to 1910 the trees were never pruned. Many of the trees were forked or had strong laterals below post length. In March, 1910, they were pruned to a switch, and the results of this type of pruning proved very satisfactory.

TRACT NO. 23.

This tract contains fifty-one hundredths of an acre. Is located just east of Tract No. 22, and has the same soil and surface conditions as 21. It is evident that the tract was used for planting seedlings that could not be used in other plantings. The stand is partly catalpa and partly ash. The trees are in rows five feet apart and are three feet apart in the rows. The stand of catalpa was only about fifty per cent., and therefore it was replanted in the spring of 1910.

TRACT NO. 24.

This is an experiment of reforesting a cleared field with black walnut. Area, two and eighty-nine hundredths of an acre. General surface, an eastern slope. The south part gently sloping to a ravine on the south boundary. Soil a yellowish white clay. Elevation five hundred and fifty feet.

This experiment was started by planting walnut seed in the fall of 1907 or spring of 1908. Some of the trees show two and some show three years' growth. The stand is about eighty per cent. The trees are spaced approximately four by four feet. In March the tract was given a moderate pruning. During the season the tract was plowed five times and hoed five times. The trees have shown a good growth to date. The tendency to grow several terminals is shown by a majority of the trees.

TRACT NO. 26.

This tract is an experiment of reforesting a cleared field to yellow poplar. This tract is really a part of tract No. 3. It was planted at the same time and in the same manner, and with the same species of trees. It is located about 30 rods to the southeast of Tract No. 3 across a ravine. The soil is a clay, with good surface drainage. Area, one and seventy-one hundredths of an acre.

In January, 1910, the whole of the tract received a moderate pruning, except ten rows on the west side, which were left to demonstrate natural pruning. The trees on this tract show a vigorous and straight growth.

TRACT NO. 27.

This is an experiment of reforesting a hillside with black locust. Soil, a clay, with good surface drainage. The exposure is a south slope. The trees are in rows five feet apart and approximately four feet apart in the rows. Stand is about ninety per cent. Prior to 1910 the trees had never been pruned. In April, 1910, the trees were pruned to a switch. The results of the pruning are satisfactory. The trees have shown a remarkable growth this year, considering that the soil is of a very poor type. The average height growth was four to six feet. The diameter growth was in proportion. Many of the trees added over an inch to their diameter during the season. The black locust is the most rapidly growing tree on the reservation.

TRACT NO. 28.

This is an experiment in afforesting a cultivated field with black walnut and shellbark hickory for the permanent stand.

The soil is a clay loam underlaid at a distance of four to ten feet with a shale, but with poor surface drainage. Elevation about five hundred and thirty feet. Approximate value of land twenty-five dollars per acre. Area nine and ninety-two hundredths acres.

This tract was planted on June 2d and 3d of 1910. The ground was too wet to plow before that time, and at the time of planting the ground was not in the most desirable condition. The season for planting was well advanced and it was not deemed wise to defer it longer. The plowing, harrowing and marking was done on May 31st, June 1st and 2d, and the planting was begun on the 2d and finished on the 3d of June.

The tract was planted on the rectangular plan, as follows: It was marked off in rows four feet apart each way. Germinated seeds of walnut and hickory were planted alternately at the intersections, sixteen feet apart. Corn was planted at the remaining four-foot intersections.

When the trees are three to five feet high it is planned to plant a post species, such as catalpa or locust, midway between the walnut and hickory. This will make the spacing of the trees eight by eight feet. When the post species has attained post size the tract will need thinning, and the post species will be removed.

The walnuts for the planting were gathered near the reservation. The hickory nuts grew in southern Indiana. The nuts were not delivered until in December, when the ground was frozen too hard to stratify them, so they were stored in the cellar until January 3d, when the ground was thawed about two inches deep, a sufficient depth to permit stratification. A sunny and well-drained place in the field in which the nuts were to be planted was selected in which to stratify the seed. No sand or gravel could be secured for the beds, so the nuts were scattered on the ground, making the nuts one layer deep. They were then covered with muddy earth to a depth of about one and one-half inches. Early in the spring a little additional earth was scattered on the beds to replace that which had been washed off by the heavy rains. On April 26th the nuts were examined and showed no signs of germinating. The beds were then covered with earth to a depth of six inches. On May 26th the beds were again examined and it was found that at least ninety-five per cent. of the walnut and ninety per cent. of the hickory nuts had germinated. The record for the germination of these species is usually much below the preceding results. The high percentage of germination is attributed, not only to good seed, but to the fact that additional earth was added to the beds which increased and retained the moisture, which is the essential thing in germinating nuts. It is believed that the nuts were never frozen after they were stratified, so that the high germination was due probably entirely to moisture. It is desirable in stratifying the seed to imbed them in sand, which makes it easier to take up the germinated seed and reduces the danger of breaking off the young shoot.

The nuts were given the gravity test before stratifying, with the following results. Of nine bushels of hulled walnuts, six and one-half bushels floated when immersed in water. Of the three bushels of hickory nuts tested, two bushels floated.

The seeds were all stratified in the same bed. The heavy seed at one end and the seed that floated at the other end. The percentage of germination was computed from the heavy seed. However, the percentage of germination among the floating seed was very high.

Only a part of the nuts stratified were used in this planting and when the seedlings in the remainder of the bed appeared above the ground no difference could be detected in the density of the stand on the part that contained the heavy seed and the part on which the light seed were stratified. These results run counter to the accepted view, that nuts or acorns which float in water will not germinate.

The planting of this tract was performed as follows: The marks in which the nuts were to be planted was deepened with a single shovel. The germinated nuts were carefully lifted from the beds and placed in half-bushel, one-handle market baskets between layers of dampened cloths. The baskets were carried by boys, who placed the nuts in the intersections. Men with hoes immediately followed the boys and covered the nuts with earth to the depth of about two inches. The result of the planting was that ninety per cent. of the walnuts grew and about forty per cent. of the hickory nuts. It is not known why more of the hickory nuts did not grow.

The expense of this tract to date is as follows:

December 20, 1910, nine bushels hulled walnuts	$6 75
December 20, 1910, three bushels hulled hickory nuts	9 00
May 31, 1910, plowing field	14 00
June 1, 1910, harrowing	10 50
June 2, 1910, marking off tract	5 10
June 3, 1910, planting nuts	6 00
June 3, 1910, planting corn and seed corn	6 75
Total cost of planting	$58 10
Plowing and hoeing tract four times during the season	30 73
Total cost of planting and cultivating	$88 83
November 25, 1910, deduct the value of the corn crop, less expense of cutting, husking, etc.	40 47
Balance of expense charged to this tract	$48 36

Tract No. 29.

This is an experiment in afforesting a cultivated field with American chestnut.

The soil is a sandy clay loam, with good surface drainage. Area of tract ten hundredths of an acre.

The trees are spaced approximately four by four feet. They were grown from the seed and appear to be five or six years old. The trees are thrifty, but when compared with the adjoining ash tract, which was planted at the same time, they are found to be more crooked and only about two-thirds as high.

Tract No. 30.

This is an experiment in growing pecan. The soil is a clay loam, with good surface drainage. Area of tract seven hundredths of an acre. It is said that this tract was begun by planting native Texas nuts in the fall of 1904. The nuts were drilled in rows four feet apart, and when the seedlings were large enough, all were transplanted except one every four feet, which were left for a permanent stand. All the transplanted seedlings died. There were ninety-two trees in the tract in the spring of 1910. In March the trees were pruned to a switch. The trees are thrifty and have made an average growth during the past season of one to three feet.

TRACT No. 31.

This is an experiment in growing the coffee tree. The soil is a sandy loam, with good surface drainage to the south. Area sixty hundredths of an acre. Seedlings were planted in the fall of 1906 in rows four feet apart, with the trees four to five feet apart in the rows. At present there is not a stand of over fifty per cent. of the coffee trees. In the spring of 1908 it was replanted with the tulip tree. The coffee trees show a stunted growth and do not average more than twenty-one inches in height after four years' growth.

TRACT No. 32.

This is an experiment in growing black locust. The soil is a sandy clay loam, with good drainage to the south. Area about half acre. The seeds were planted in the fall of 1904, in rows four feet apart. In the spring of 1906 all of the seedlings were transplanted except one every four feet, which were left for a permanent stand. The tract was pruned but little until January, 1910, when it received a moderate pruning. The trees in this tract are the largest locust on the reservation. They have made a rapid growth and some are over three inches in diameter. The locust borer has attacked several of the larger trees, but to what extent it will injure them in the future, can only be conjectured.

TRACT No. 33.

This is an attempt at afforesting a cleared field with a pure stand of catalpa.

The soil is a clay loam, with good surface drainage, to the east. The land is valued at $30.00 per acre. Area of tract, six and forty hundredths acres. This tract was planted in the spring of 1910. The ground was plowed, harrowed and marked off, four feet each way, as for corn. Every other mark was made deeper with a single shovel. The seedlings were dropped in this furrow at the alternate intersections, which makes the spacing of the trees eight by eight feet. Men followed the boys, who dropped the seedlings in the furrows, with hoes and planted the trees.

The tract is divided north and south into four major compartments. The first four rows of trees on the east side of the tract make up compartment "A," which is to receive no cultivation, to show the value of cultivating catalpa. The next four rows of trees to the west constitute compartment "B," which received four cultivations during the season, but contained no undercrop. The next four rows of the trees to the west of compartment "B" compose compartment "C." The remainder of the tract is compartment "D." Compartments "C" and "D" were planted with corn at the intersections where there were no trees. The trees were planted eight by eight feet apart in order that they might not need a thinning before they reached post size, and also to enable a wagon to pass between the rows when marketing the undercrop and forest products. The tract was undercropped in order to reduce the cost of the investment. Corn was chosen in preference to any other crop, because corn affords protection from the wind and induces the trees to grow taller. Compartment "B" and "C" were planned to demonstrate this point. On November 4th the growth was measured on 100 trees in each of the compartments "A," "B" and "C," with the following results:

Average growth of 100 trees of compartment "A," which received no cultivation was 7.47 inches.

Average growth of compartment "B," which was cultivated, but had no undercrop, was 9.16 inches.

Average growth of compartment "C," which was undercropped with corn, was 13.28 inches.

This comparison shows that cultivation adds 22.6 per cent. to the height growth, and that undercropping with corn increases the height growth an additional 44.9 per cent. in addition to the value of the corn crop. The trees undercropped with corn show 77.7 per cent. greater height growth than the ones that were not cultivated.

The items of expense on this tract to date are as follows:

April 7-11, 1910, plowing	$10 50
April 11, 1910, harrowing	4 95
April 25, 1910, marking off tract	4 05
April 25, 1910, planting trees	6 07
April 29, 1910, planting corn and cost of seed	4 37
April 1, 1910, 4,500 catalpa seedlings and freight	12 25
Total cost of planting	$42 19
Cost of four plowings and four hoeings	21 40
Total expense at end of season	$63 59
Deduct the net value of the corn crop	63 39
Total cost of investment to date	20

If the whole of the tract had been undercropped with corn and would have yielded in proportion to the part which was undercropped, the cost of this investment would have been reduced an additional $13.15, which would have not only paid for the seedlings, cost of planting and cultivating, but would have left a balance of $12.95. If the tract is undercropped with corn next year with a yield of 20 per cent. less than this year, the net proceeds would be $11.15, which added to the net proceeds of the first year would make $24.10. Deduct this amount from $30.00, the value of the land, leaves $5.90, which represents the amount of the investment at the end of the second year. If, after this time there is nothing more done to this tract it remains to be determined what per cent. income the forest crop will make on an investment of $5.90, plus the taxes on a tract of land assessed at about $120.00.

TRACT NO. 34.

This is an experiment in afforesting a cleared field with ash. The soil is a whitish clay with a compact subsoil. The surface drainage is good and toward the southwest. Area is three and seventy-nine hundredths acres. The tract was planted with seedlings in the spring of 1909. The planting was done by plowing a furrow about every eight feet. The seedlings were dropped into the furrow at distances of six feet and were covered by plowing a furrow back to cover them. They were then straightened up by workmen who followed the plow. This tract received but one plowing and hoeing in 1909.

The stand in the spring of 1910 was about sixty per cent. The poor stand is due to the fact that the cultivation was neglected so long that when it was attempted many of the seedlings were plowed up or plowed under with the bar-shear plow used, and some were cut off by the hoemen.

This spring corn was drilled between the rows, and *thirty-three* bushels were harvested. The tract received four cultivations and four hoeings this season. Next year it is planned to replant this tract so far as is necessary to complete the stand.

TRACT NO. 35.

This is an experiment in afforesting a cleared field with ash. Soil in the main is a light-colored clay, with the southeast corner of the tract a sandy loam. There is a good surface drainage toward the east. Area five and sixteen hundredths acres.

This tract was planted with seedlings in the spring of 1909, in rows about seven feet apart, with the trees approximately six feet apart in the rows. This tract was planted at the same time and in the same manner as the preceding tract. The stand in this tract in the spring of 1910 was about ninety-five per cent.

This tract received four cultivations and four hoeings during the season. The cultivating was begun early in May, and as a result the trees have made a rapid growth this year.

TRACT NO. 36.

This is an experiment in afforesting a cleared field with ash. The soil is a clay loam. There is good surface drainage toward the north. Area, four and eleven hundredths acres.

This tract was planted with seedlings in the spring of 1908. The trees were planted in rows five feet apart, with the trees five feet apart in the rows. They were planted in the same manner as in tracts Nos. 34 and 35.

In February, 1910, the tract was given a moderate pruning. The trees in this tract have made a rapid growth. Some of the trees in the richest part of the tract are over fifteen feet high. See Plate 3.

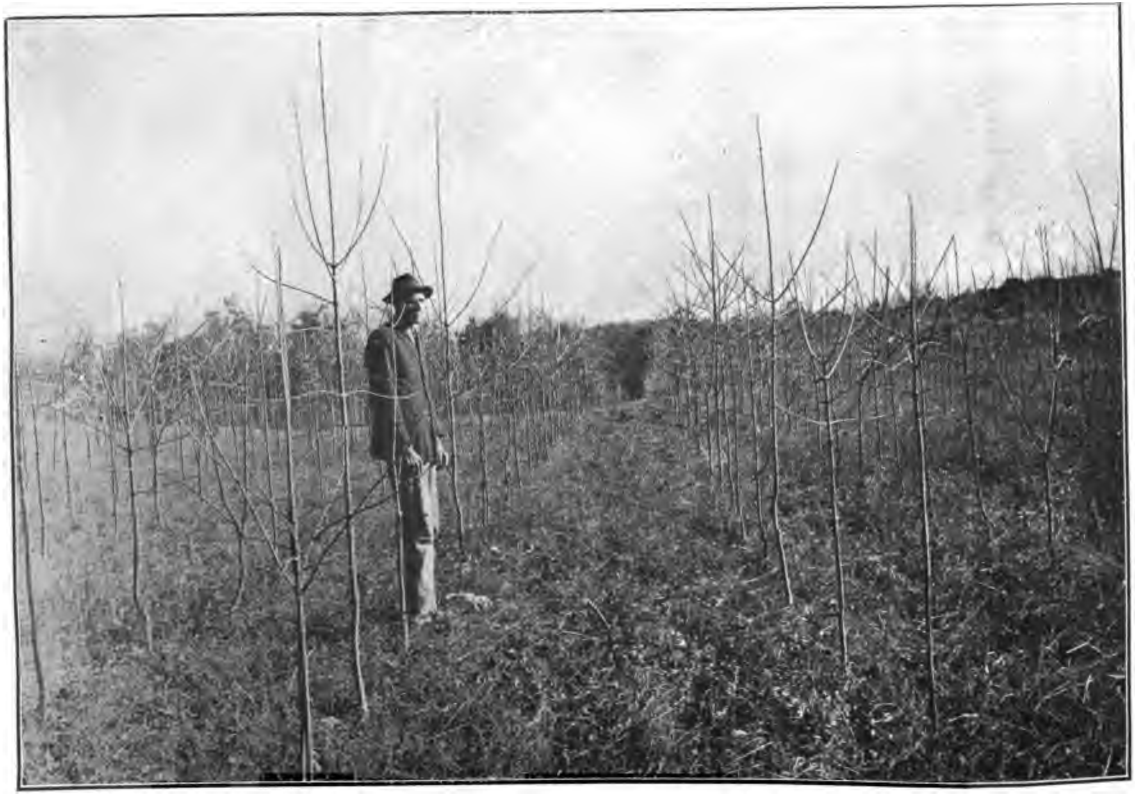


Plate 3. White Ash in tract 36 at Reservation. Seedlings planted spring 1908.

TRACT No. 37.

This is an experiment in afforesting a cleared field with ash and elm. The soil is a light colored clay with a compact subsoil, locally known as "cray-fish" land. The surface is flat, with poor drainage, although almost surrounded by two ravines. Area six and twenty-two hundredths acres.

The tract was planted in the spring of 1908. The trees are in rows five feet apart and are spaced approximately five feet apart in the rows. The ash and elm are planted in alternate rows. The trees were planted in the following manner: Holes were made in the ground with a "V"-shaped spud. The trees were placed in the hole and firmed in the ground by pressure with the foot. The result of this kind of planting is that the trees have grown very slowly. However, the trees appear to have recuperated to a certain extent this season. The present stand is about ninety per cent. of ash and forty per cent. of elm.

TRACT No. 38.

This is an experiment in afforesting a cleared field with ash and elm.

This tract is really a part of the preceding tract. It is separated from tract No. 37 on the south by the public road. The soil and drainage are the same. The species planted, spacing and manner of planting are the same as in No. 37. Area, two and fourteen hundredths acres.

TRACT No. 39.

This is an experiment in afforesting a cleared field with mixed hardwoods.

This tract of four and eighteen hundredths acres contains the same kind of soil as the preceding tracts, and is drained in like manner. The present stand of trees indicates that nuts of mixed oak, hickory, walnut and chestnut were planted in rows about four and one-half feet apart in the fall of 1904. The result was a stand of about ten per cent. In the spring of 1908 the tract was replanted with ash and elm. The two species were planted in alternate rows, about four and one-half feet apart in the rows. The ash and elm in this tract were planted with the spud. The general conditions of the tract are the same as in the two preceding tracts.

TRACT No. 40.

This is an experiment in afforesting a cleared field with catalpa.

The soil is a clay loam. The tract is level, with good surface drainage. Area, two and fifty-three hundredths acres. This tract was planted with seedlings in the spring of 1908. The trees are in rows about six feet apart and spaced from three to six feet apart in the rows. The stand is approximately ninety per cent. The trees made a growth of two to five feet during the past season.

TRACT No. 41.

This is an experiment in afforesting a cleared field with hardwoods.

The soil is a clay porous loam. The surface is flat. The tract is almost surrounded by ravines, which give it good drainage. Area, five and four hundredths acres. There is no record of how or when the tract was planted. The growth of the several species planted indicate that it was planted with seedlings in the spring of 1908. On the north side there are three rows of catalpa about twelve feet apart. Between the rows of catalpa an occasional walnut less than a foot high is seen, which shows that walnuts were planted at the same time.

The remainder of the tract is planted in rows five feet apart, with the trees spaced about five feet apart in the rows. The species planted are catalpa, locust and yellow poplar, in alternate rows. In the spring of 1910 the stand of catalpa and locust was about ninety per cent. The stand of yellow poplar was approximately twenty per cent.

It is evident that up to the present time the results of the forest plantings on the reservation are indicative, rather than demonstrative. This is due in part to the long time that must elapse, even under the best conditions, before sufficient data can be collected to make generalizations safe, and partly to the fact that it takes time to elaborate a system of records which are both comprehensive and at the same time of sufficient detail. It is believed, however, that in this report a base line has been established by giving in detail the purpose of the work upon each tract, the expense involved and the results obtained. The additional data secured will, under this plan, fall into their appropriate place, and will have an increasing significance from year to year.

Woodland Area of the Reservation.

About seventeen hundred acres of the reservation is covered with second growth. There are practically no trees of any value over a foot in diameter. There are several hundred acres that contain approximately fifty trees to the acre, that have a diameter of from six to twelve inches.

Approximately six hundred acres of the northwest part of the reservation is in the "knobs" region and covered principally with chestnut oak (Quercus Prinus) and yellow pine (Pinus echinata). Chestnut oak (Quercus Prinus) is also the principal species on the lower slopes of the knobs.

The remainder of the woodland area is about three hundred feet lower than the knobs. The whole of this area is what is popularly called the "black and white oak land." The principal species are white oak (Quercus alba), chestnut oak (Quercus Prinus), scarlet oak (Quercus coccinea) and black oak (Querus velutina), enumerated in the order of their abundance. There is one ridge near the base of the knobs where chestnut is the principal species. It is found elsewhere only as isolated trees. On a few of the hills the post oak (Quercus stellata) is the most abundant. The hills are the poorest soil on the reservation. Scattered over the reservation are a few black (Carya glabra) and shellbark hickory (Carya ovata). On areas from which most of the timber has been removed and permitted to reforest, black hickory is the dominant species. Several hundred acres in the north central part was burned over about ten years ago and since has grown up to be an "impenetrable wilderness."

The ubiquitous sassafras is to be regarded as a nuisance, except as a nurse tree. On one small "flat," sweet gum is the prevailing species. Along the ravines are found birch, elm, sycamore, sweet gum, etc., variously distributed. Yellow poplar, ash, beech and hard maple, indicative of good soil, are rare, being noted only occasionally on the lower slopes of the hills. There are other species of trees, but in limited numbers.

About six hundred acres of the woodland has had a forest cleaning. In 1907 several plots of the woodland were calipered to show the relative abundance of the species and the size of the stand. A record of these measurements is contained in the Seventh Annual Report, but it is not stated at what height the measurements were taken. Judging from the present size of the trees the measurements must have been taken one foot above the ground. The same tracts were calipered in November, 1910, four and one-half feet above the ground, with the following results:

"Plats 6A and 6B are experiments of the natural reproduction of hardwoods upon an abandoned new-ground field, which was cultivated to corn and tomatoes jointly during three seasons, and last during the summer of 1903. When the crop was removed it was permitted naturally to grow up to trees. This last September, 1907, it was given the forest cultivation clearing. The tabulation given in the tables, 6A and 6B, show the prime stand of trees retained at cultivation. The count was taken in two different parts of the field and shows an average of 1,135 trees per acre.

"Soil, porous sandstone clay. Elevation, 590 feet. Natural rolling surface drainage." (From Seventh Annual Report, page 92.)

Plat No. 6A. Natural Reproduction Hardwoods. One-half Acre.

Diameter, inches.	Oak.	Hickory.	Walnut.	Maple.	Black Gum.	Elm.	Mulberry.
½.....	20	101	6	2	9	..	..
1	56	133	4	1	2	1	2
1½.....	48	6	2	..	..	..	..
2	30	..	..	..	..	..	..
2½.....	11	..	..	..	..	..	..
	165	240	12	3	11	1	2
Total							434

Plat No. 6B. Natural Reproduction Hardwoods. One-half Acre.

Diameter, inches.	Oak.	Hickory.	Wanut.	Maple.	Black Gum.	Mulberry.	Cottonwood.
½.....	14	92	..	..	1	..	..
1	78	161	5	2	..	..	..
1½.....	83	19	1	..	..	2	..
2	44	2	..	..	..	..	1
2½.....	13	..	..	..	..	..	..
3	6	..	..	..	..	..	..
3½.....	1	..	..	..	..	..	..
4½.....	1	..	..	..	..	..	1
	240	274	6	2	1	2	2
Total							527

"Plat No. 10 is an experiment, giving the number of standing hardwood trees per acre after the forest cleaning was applied. There has been near 380 acres so treated and this experimental tract is an average for the lot. This forms the upper story forest and will be removed when it attains a suitable commercial size, and the lower story forest indicated which follows the cultivation will succeed it, and so on forest perpetuation is accomplished on such lands." (From Seventh Annual Report, page 99.)

Plat No. 10. One Acre. Old Growth.

Diameter, inches.	White Oak.	Black Oak.	Chestnut Oak.	Hickory.	Black Gum.	Pine.
1	13	3	5	8	..	..
2	29	5	7	3	..	..
3	34	6	17	2	..	..
4	26	10	26	..	1	..
5	27	7	9	..	..	..
6	6	8	18	2	..	..
7	5	9	11	1	..	1
8	3	10	5	1	..	..
9	3	5	4	4	..	1
10	1	3	3	2	..	..
11	..	1	..	3	..	..
12	1	..	2	2	..	..
13	..	..	..	1	..	..
14	..	1	..	..	..	..
15	..	1	..	1	..	..
	148	69	107	30	1	2
Total						357

"Plat No. 11 is an experiment at natural reforestation upon a tract cleared off and farmed two seasons to corn and then permitted to grow up. The area of which this plat is a part was last farmed in 1901. It was given the forest cultivation in the winter of 1904. The tabulations show the result. This area has hard blue sandstone clay soil, and elevation 620 feet. Drainage, natural rolling. Approximate trees per acre, 2,998." (From Seventh Annual Report, page 100.)

Plat No. 11. One-half Acre Natural Reproduction in Abandoned Field.

Diameter, inches.	Oak.	Chestnut.	Hickory.	Black Gum.	Maple.	Ash.
½	9	1	63	..	..	..
1	53	1	272	2	4	1
1½	57	2	80	4	1	1
2	68	1	39	2	1	1
2½	31	2	7	..	..	..
3	34	..	..	..	..	1
3½	16	..	..	..	..	..
4	6	..	..	..	..	..
4½	2	..	..	..	..	..
5	1	..	..	..	..	..
	277	7	461	8	6	4
Total						763

"Plat No. 14 is an experiment of a tract of natural woodland which has been cultivated and shows the predominance of hickory in the stand. This tract is an example of an ordinary devastated jungle growth found upon the Reservation, as well as throughout the 600,000 acres of hilly broken lands of southern Indiana, and shows what is there for future forests if they are cultivated and not burned over.

"The soil of this tract is heavy white and blue sandstone clay, with natural rolling surface drainage." Elevation, 630 feet. (From Seventh Annual Report, page 103.)

Plat No. 14. Half Acre. Woodland.

Diameter, inches.	White Oak.	Black Oak.	Chestnut Oak.	Black Gum.	Maple.	Chestnut.	Hickory.
½.....	4	4	..	2	..	..	2
1	11	24	4	4	4	..	15
1½.....	28	24	7	7	7	..	6
2	14	8	24	3	2	..	2
2½.....	12	6	19	1	3	2	..
3	6	4	7	1	5	2	2
3½.....	5	1	10	..	..	3	..
4	2	3	4	..	1	..	..
4½.....	1	2	2	..	..	1	..
5	1	1	1	..	..	2	..
5½.....	..	2	2	..	..	..	..
6	..	..	2	..	..	..	..
7	..	..	3	..	..	..	..
7½.....	1	..	1	..	..	..	..
8	..	1	2	..	..	..	1
8½.....	1	1	..	..	..	..	1
9	..	1	1	..	..	..	..
9½.....	1	1	..	..	..	..	..
10	..	..	1	..	..	..	..
11½.....	..	1	1	..	..	..	..
13	..	1	..	..	..	..	1
14	..	1	..	..	..	..	..
19	..	..	..	1	..	..	..
20½.....	..	..	..	1	..	..	..
	87	86	91	20	22	10	30
Total							346

"Plat No. 15 is an experiment of natural forest growth on the slopes and base of knoblands. This area was a badly devastated one by fire and slaughter by careless cutting when the Reservation was purchased. In the fall of 1904 the area was thoroughly cultivated by forest cleaning as is conducted at the Reservation. The tabulation shows the variety of the trees and sizes now growing. A peculiar thing about the entire knobland forest growth is the variety of the trees growing successfully upon them that are not at all considered adapted to them. Upon these lands Chestnut Oak and American Chestnut take the predominance over White Oak.

"The soil of this area is purely sandstone clay of the hard, shaley kind. Elevation, 820 feet. Surface, broken ridges." (From Seventh Annual Report, page 104.)

Plat No. 15. One-half Acre. Natural Growth.

Diameter, inches.	White Oak.	Black Oak.	Chestnut Oak.	Hickory.	Maple.	Chestnut.	Black Gum.	Ash.	Cottonwood.
½	1	6	4	9	1	..	4	1	..
1	17	18	37	32	13	1	14	1	..
1½	15	19	48	9	11	1	15	1	..
2	14	28	52	3	11	3	6	..	1
2½	17	15	57	..	2	1	2	..	1
3	10	10	55	..	2	3	2	..	..
3½	5	3	31	..	..	1	..	..	1
4	5	1	19	..	3	..	..	..	2
4½	..	2	9	..	1	..	1	..	..
5	..	..	3	..	..	..	..	..	..
5½	..	..	2	..	..	2	..	..	..
6	..	..	..	..	..	1	..	..	..
6½	..	..	2	..	..	..	1	..	..
7	1	..	3	..	..	..	..	..	..
8	..	..	1	..	..	..	..	..	..
9	..	..	1	..	..	..	..	..	..
9½	..	..	1	..	..	..	..	..	..
10	..	..	1	..	..	..	1	..	..
10½	..	..	1	..	..	..	..	..	..
11½	..	..	2	..	..	..	..	1	..
12½	..	1	..	..	..	..	..	..	..
14	..	..	..	1	1	..	..	..	..
	85	103	329	54	45	13	46	4	5
Total									684

Plat No. 17 is an experiment of natural forest growth, same plan and purpose as in No. 15. This elevation, however, is about 850 feet, and is in the altitude of coniferous trees. The knoblands grow pine successfully, and another characteristic is that the other species are abundant, as shown by the tabulation. However, the pines are gradually giving way to the hardwoods which form the second story forest under them. A great many young pines are coming on and regeneration by pine seems possible.

Plat No. 17. One Acre.

Diameter, inches.	White Oak.	Chestnut Oak.	Black Oak.	Maple.	Hickory.	Pine.	Ash.
½.....	5	3	..	..	51	4	..
1	32	46	8	4	188	11	3
1½.....	33	34	7	2	47	15	2
2	22	26	5	1	5	9	..
2½.....	14	19	5	1	6	2	..
3	14	15	4	2	2	3	...
3½.....	12	12	3	1	..	1	..
4	11	19	4	..	1	..	..
4½.....	8	10	4	..	..	..	..
5	3	19	4	..	..	1	..
5½.....	..	10	..	..	1	..	..
6	1	9	9	..	1	1	..
6½.....	3	13	6	..	..	..	..
7	7	6	5	..	1	..	..
7½.....	3	3	2	..	..	..	..
8	2	8	4	..	1	..	..
8½.....	2	1	1	..	..	..	..
9	1	5	4	..	..	..	..
9½.....	..	..	..	..	..	1	..
10	2	2	1	..	1	..	..
10½.....	1	..	..	..	1	..	..
11½.....	3	..	1	..	..	..	..
12	..	3	1	..	1	..	..
	179	273	78	11	307	48	5

Total 901

Field Planting.

Tract No. 28, of nine and ninety-two hundredths acres, was planted to walnut and shellbark hickory in the spring of 1910. Tract No. 33, containing six and forty hundredths acres, was planted to catalpa, making a total of sixteen and thirty-two hundredths acres planted to forest. The detailed account of these plantings will be found in their respective places under the heading, Experimental Tracts.

This spring the ash seedlings in the nursery were transplanted. This work was made necessary by the many freezes, which spewed most of the seedlings out of the ground. In some places all of the seedlings in the row for a distance of a rod or more were found lying on the surface. About twenty thousand seedlings were saved and transplanted in rows about three feet apart, spaced about six inches apart in the rows.

It was also considered advisable to plant a small orchard of fifty trees near the administration building. Mr. William Waltman, a member of the board and an experienced horticulturist, was named to select the varieties and to superintend the planting. The total cost of the orchard to date is eighteen dollars and nineteen cents. This includes the preparation of the ground, cost of trees and planting. The custodian uses the tract as a garden, so no charge of cultivation is made against the tract.

FIELD CULTIVATION.

The weather during the months of May, June and July was too wet to be favorable for cultivation. It made both plowing and hoeing less effective, and greatly increased the cost of keeping down the grass and weeds. In spite of the adverse weather, however, at the end of the season all the plantings were comparatively clean. They contained few sprouts, briars and weeds, other than the five-finger grass, which took possession after the cultivation was completed.

The plowing is done with mules. They are slow in turning when plowing, which increases the cost of plowing, since the tracts are small and the length of the rows is short. All the tracts were plowed four or five times, except No. 1, which was laid by with one plowing because the root system had covered the ground.

For a detailed account of the cultivation done, see table on page 16.

PRUNING.

During the winter months of the year, seventy-one and twenty hundredths acres were pruned. This work was done by the custodian and the teamster when other work was not urgent. The work was all done with the "hawkbill" pruning knife, except the coppicing, which was done with a saw. No doubt the saw is one of the best instruments for coppicing, but the work is fatiguing and slow. Many of the owners of catalpa planting use an ax in this work, which is objectionable, because the blow usually splits the stump. This fall a coppicing scythe was tried with good results. This does the work satisfactorily, is rapid, and not tiresome.

Plate No. 4 shows how quickly the wounds on white ash heal.

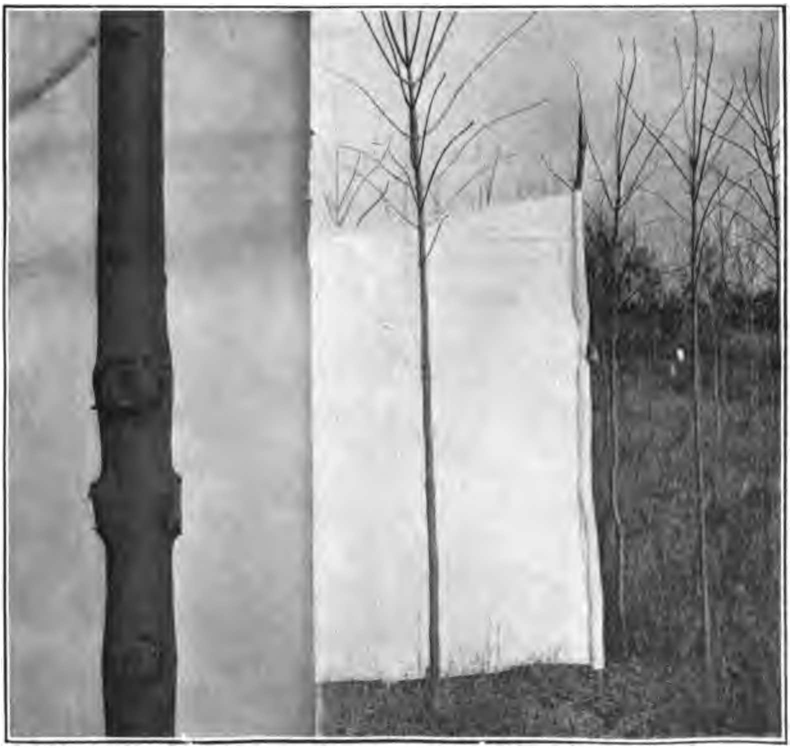


PLATE 4. White Ash in tract 1B, pruned April 10, 1910. Left side of the plate is a closer view of the one on the screen.

GROWTH.

The conditions for forest growth at the reservation during the past season were favorable. There were frequent and abundant rains during the entire season, which caused an unusual growth of all species.

During the season at irregular intervals the growth of several species of trees was measured to determine the periodicity of growth. It is to be regretted that the measurements could not have been taken at regular intervals, and a smaller scale used. Next year it is hoped to extend the work, using a greater number of species and individuals. Also the measurements to be taken will be reduced to smaller divisions of an inch to obtain more accurate results.

The following is a record of the measurements taken, which are very suggestive:

DATES ON WHICH MEASUREMENTS WERE TAKEN.

Exp't. No.	Species Used.	Year Planted.	May 10th.	June 9th.	June 29th.	July 29th.	Aug. 29th.	Sept. 7th.
1	Ash	1905	18 in.	38 in.	40 in.	40 in.	40 in.	....
2	Ash	1905	15 in.	26 in.	26 in.	28 in.	30 in.	....
3	Ash	1905	16 in.	32 in.	35 in.	35 in.	35 in.	....
4	Ash	1905	15 in.	26 in.	27 in.	28 in.	29 in.	....
5	Ash	1905	3 in.	29 in.	33 in.	33 in.	33 in.	....
6	Ash	1905	6 in.	35 in.	35 in.	35 in.	37 in.	....
7	Ash	1905	14 in.	39 in.	40 in.	40 in.	40 in.	....
8	Ash	1905	5 in.	26 in.	27 in.	27 in.	27 in.	....
9	Ash	1905	15 in.	24 in.	24 in.	24 in.	24 in.	....
10	Ash	1905	13 in.	24 in.	25 in.	26 in.	26 in.	....
11	Ash	1905	17 in.	29 in.	36 in.	36 in.	36 in.	....
12	Poplar	1907	2 in.	7 in.	17 in.	31 in.	38 in.	....
13	Poplar	1907	2 in.	8 in.	19 in.	29 in.	34 in.	39 in.
14	Poplar	1907	2 in.	10 in.	24 in.	37 in.	41 in.	41 in.
15	Poplar	1907	2 in.	10 in.	24 in.	33 in.	30 in.	....
16	Poplar	1907	2 in.	7 in.	13 in.	27 in.	30 in.	....
17	Walnut	1906	2 in.	12 in.	22 in.	28 in.	28 in.	28 in.
18	Walnut	1906	2 in.	8 in.	18 in.	24 in.	24 in.	25 in.
19	Catalpa	1907	4 in.	5 in.	15 in.	19 in.	23 in.	29 in.
20	Catalpa	1907	4 in.	9 in.	13 in.	20 in.	23 in.	25 in.
21	Catalpa	1907	6 in.	10 in.	19 in.	31 in.	33 in.	34 in.
22	Catalpa	1907	5 in.	17 in.	19 in.	21 in.	21 in.	21 in.
23	Catalpa	1907	6 in.	12 in.	27 in.	43 in.	69 in.	71 in.
24	Chestnut	1905	4 in.	11 in.	22 in.	24 in.	24 in.	24 in.
25	Chestnut	1905	2 in.	4 in.	17 in.	23 in.	25 in.	26 in.
26	Ash	1908	12 in.	35 in.	42 in.	48 in.	50 in.	....
27	Ash	1908	14 in.	23 in.	23 in.	32 in.	35 in.	....
28	Ash	1908	18 in.	26 in.	27 in.	27 in.	27 in.	....
29	Ash	1908	16 in.	24 in.	24 in.	24 in.	24 in.	....

From the above measurements it can be noted that ash cultivation should be begun very early and may be discounted about the middle of June. The annuals that would grow after that date would be a benefit rather than a detriment. However, other species of trees that do not complete their growth until late in the growing season would be retarded in their growth by many weeds.

The measurements show that the cultivating season for ash would be of about six weeks' duration, while that of catalpa or yellow poplar would be twelve weeks. This means that the last two named species must have a greater number of cultivations than the ash to receive the same annual benefit.

FOREST CLEANING.

This work was confined to the cleaning of two ravines between the cleared fields in the southeast part of the reservation, and a strip about two rods wide on each side of the public road.

The work done along the ravines was from three to ten rods wide, and about one hundred rods long. The sides of the ravines were covered with a thick stand of briars and bushes, which were removed, and what few forest trees were found were left standing.

In October seeds of white oak were dibbled in on the higher parts of the ravines. The seeds of other suitable species would have been used also, but they were not obtainable. The bottoms of the ravines are flat, with poor drainage, and were covered with tall wild grass. This was plowed under and in the spring seedlings of elm and sycamore will be dibbled in on these flats. Thus it is hoped to reclaim these two ravines, which have heretofore been only the hiding places for rabbits.

INSECTS.

There was little damage at the reservation this year. The following observations are reported because they may be of value in studying the insect damage in the future.

The coffee tree was partially defoliated again this year. About twenty-five per cent. of the leaf surface was eaten by some undetected insect.

The locust borer has attacked some of the five-year-old locust trees. Several of the adults were observed on the trees late in September, and increased numbers are expected to appear next year.

The effect of the locust twig borer is frequently noted among the five-year-old locust trees. The trees suffer but little from this insect. A few three-year-old trees have also been attacked.

The catalpa sphinx appeared late in September near the center of Tract No. 40, planted to catalpa, and partially defoliated a few trees. The trees in this tract are three years old. This is the first time the catalpa sphinx has been noted on the reservation.

The larva of the Datana sp. partially defoliated a number of the pecan trees. They did not appear until the latter part of September, or else the whole tract would have been defoliated.

The twig girdler is not infrequent on the reservation. It works principally on the hickory and persimmon. See Plate 5. One persimmon tree in particular was noted that was not over fifteen feet tall, which had most of its branches cut off. The greater number of the branches amputated were about three-eights of an inch in diameter.

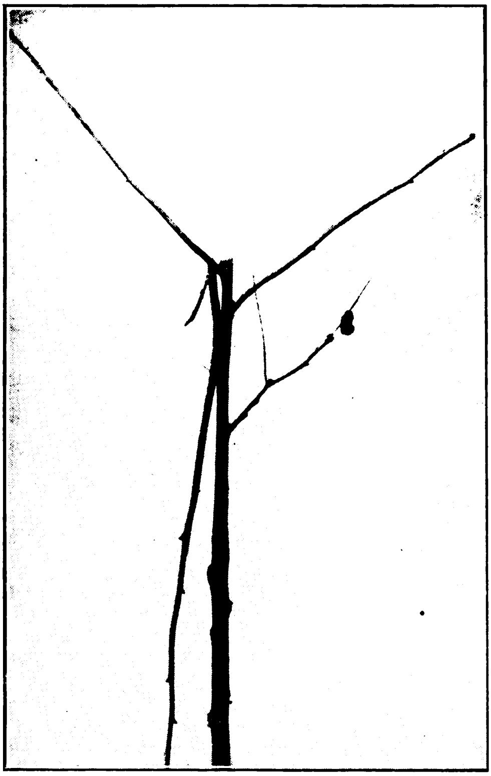


PLATE 5. Terminal of young hickory cut off by Twig Girdler.

In the latter part of September the beetle (Xyloryctes satyrus Fab.) entered the ash Tract No. 1. Fully thirty per cent. of the trees had burrows at their bases. Usually one female only was found at the base of each tree. Since the larvae of the beetle feed on the roots of the ash, the invasion of the insect will no doubt result in some injury to the trees. In order to determine the extent of the injury it was planned to mark the trees that had burrows at the base, but a severe rain-storm washed the surface to such an extent that the burrows were not visible.

An aphid attacked the leaves of the chestnut during the summer, but the damage was slight.

FOREST FIRES.

There has been no forest fire this year. This fall the boundary fire line was cleaned. In addition to this precaution against fires, two interior lines were constructed. This work consisted in cleaning the woodland a distance of ten to fifteen feet on each side of two abandoned wagon roads, which divide the reservation, north and south, into three nearly equal parts. All the brush, logs and green material cut, were burned in the discarded road.

Cloth fire signs are posted at short distances around the boundary and along the roads running through the reservation.

HUNTING.

No hunting is permitted on the reservation. Game preserve signs are posted in conspicuous places around the entire boundary and along the roads through the reservation. No attempt has been made to violate the law.

GENERAL IMPROVEMENTS.

A tool-house was built last fall near the center of the reservation, one and three-fourths of a mile from the Administration Building. The construction of a tool shed was justifiable, because a majority of the plantings are in that neighborhood, and there was no place closer than one and three-fourth miles in which to keep the tools or shelter the men in case of a rain-storm. The building is twenty by forty feet and ten feet high to the "square." The foundation is solid concrete. The lumber used was sawed from logs cut on the reservation. It is sided up and down and the cracks stripped. The roof is galvanized iron. Two coats of paint were applied this fall. It was built by the custodian and teamster when other work was not urgent. The total expense, exclusive of their labor, was less than ninety dollars.

The eight-room house on the "knobs" was painted with two coats of white paint in September.

The hen-house, near the Administration Building, was roofed with galvanized iron.

The open ditch in the park in front of the Administration Building, had washed to a depth of four or five feet, and to an equal width. This ditch, to the length of over four hundred feet, was tiled and filled to the level with earth.

The cracks in the Administration Building (log) were daubed, both inside and outside. The daubing on the inside was painted white. The porches and porch floors were also painted.

The orchard of a little over an acre was fenced with a four-foot woven wire fence. The total cost of the fence for material that had to be bought was eleven dollars and fifty cents.

VISITORS.

The reservation was purchased for the purpose of determining by experiment which of the forest trees are best adapted to reforesting in Indiana. The purpose of the purchase has been extended until there are now on the reservation twenty-eight tracts planted to forest trees. The kind of trees planted are those that experience has suggested to be the most suitable for Indiana. The trees on some of the plantings are now large enough that the success or failure of the experiment may be predicted. So the time has arrived when the forest plantings on the reservation are really demonstrative of what may be expected by artificial forest planting.

The work accomplished at the reservation is worth the visit of any one who is interested in forest planting. Even if one does not anticipate planting forest trees a drive through the many plantings would be a pleasure and instructive.

Visitors are always welcome at the reservation. It is suggested that on your arrival you go at once to the Administration Building on the hill, and state the object of your visit. Then the custodian will be summoned, who will take pleasure in showing you the things in which you are interested.

The following is a list by States of the number of visitors who registered at the reservation during the past year: Indiana, three hundred and seventy-eight; Kentucky, twenty-five; Ohio, six; Illinois, four; Pennsylvania, four; Minnesota, two; Iowa, one; Michigan, one; Missouri, one; Florida, one. Total number four hundred and twenty-four. On July 28, 1910, a general invitation was extended to the public to visit the grounds, and people from all parts of the State responded. It rained all forenoon of July 28, which prevented many people from attending. Nevertheless, all who attended expressed themselves as being well paid for both money and time spent in making the visit. It took some of the visitors, who lived a great distance from the reservation, two days to make the trip, and they were the most enthusiastic in their praise of the demonstration. It is hoped that more of the citizens of Indiana will avail themselves of the pleasure and profit to be gained by a visit to this place.

RECEIPTS FROM SALES.

The receipts from sales for the fiscal year were as follows:

Nov. 1, 1909.	Homer Guernsey, 4 cds. wood at 80c	$3 20
	Henry Dueser, 1 rick of wood	60
	Jesse Righthouse, ½ cd. wood	50
	Mrs. Townsend, 2 cd. wood	2 50
Nov. 30, 1909.	Henry Dueser, 1 cd. 4 ft. wood	1 00
Nov. 30, 1909.	Ira Smith, collection from logs sold	15 98
Dec. 28, 1909.	Chas. Guernsey, 52 shocks fodder at 15c	7 80
Feb. 28, 1909.	F. Ester, 1 cd. 4 ft. wood delivered	1 75
July 13, 1909.	Will Jones, 1 cd. 4 ft. wood delivered	1 75
July 13, 1909.	Chas. Dean, 15 shocks fodder	3 30
Sept. 29, 1909.	William Jones, 1 cd. 4 ft. wood	1 75
Total		$43 38

Office Work.

The office work is done by the secretary and stenographer. The work may be grouped under four heads.

First: The answering of all correspondence and complying with requsts for annual reports.

Second: Superintending the Forest Experimental Station and recording the details of the different experiments.

Third: The field work, which consists of visits of inspection of forest plantings and woodlots.

Fourth: The promoting of forestry in the State by such work as press bulletins, lectures, etc.

A detailed account of the workings of the office is given in this report in order that the public may know the extent of the work that is being done and how it is accomplished.

Correspondence.—All letters are promptly answered. A carbon copy is taken of all letters written, attached to and filed with the letter to which it is a reply. All letters are filed alphabetically and chronologically in filing boxes.

Within the fiscal year fifteen hundred and thirty first-class letters have been received. Sixty-two hundred second-class letters have been mailed. The number of first-class letters mailed was not kept until April 1, 1910. From that date until October 1st, the months of least correspondence, five hundred and seventeen were mailed.

Requests for Annual Reports.—Requests for annual reports are frequent and promptly complied with. The requests are from farmers, business and professional men, school teachers, pupils and librarians, which indicate that the people as a whole are interested in the work.

A permanent record is kept of all reports sent out. This shows which year's report is sent, to whom, his business or profession and address. During the year the following reports have been mailed: Twenty copies of 1901, thirty-six copies of 1906, seventy-five copies of 1907, one hundred copies of 1908, eight hundred and ten copies of 1909; twenty-five copies of 1909 were also sent by express, making a total of one thousand and thirty-six copies distributed during the year. The supply of reports is now reduced to a few copies of the 1907 and 1909 reports. The number of the 1909 reports printed was cut from thirty-five hundred to two thousand, the majority of which were issued in paper cover.

Mailing Lists.—Three mailing lists are used in the office. The card system of mailing lists is used in order that the additions and corrections can be easily made.

One list contains the address of all persons to whom the next annual report is to be sent. The second list is styled the "permanent" list and contains the address of persons, colleges, schools, offices, etc., to which the annual reports are to be mailed without application. The third is the newspaper mailing list. This contains the addresses of all the newspapers published in Indiana, and also the names of individuals, schools, colleges, etc., interested in receiving our press bulletins.

Library.—The library now numbers seven hundred sixty-seven accessions, of which two hundred and ninety-nine were added during the year. Each accession is topically card catalogued as soon as received.

Press Bulletins.—The press bulletin is the cheapest and most effective way of promoting forestry work. In Indiana there are nearly five hundred newspapers. Suppose twenty per cent. of them, with an average circulation of one thousand, publish our bulletins; this means that two hundred thousand people read each bulletin issued. This estimate is conservative, since the farm papers of Indiana and the Indianapolis papers, with a combined circulation over one hundred and fifty thousand, usually publish all the bulletins.

The total expense to issue and mail one of our press bulletins is usually less than seven dollars and never exceeds seven dollars and seventy-five cents. This is less than it would cost to pay car fare and hotel expenses to go to some distant part of the State to give a talk or two on forestry to an audience of a hundred.

The press bulletins are written in newspaper style and are given attractive headlines in order to attract the attention of the reader. During the year ten bulletins were issued, copies of which follow:

[Press Bulletin No. 1—Issued October 12, 1909.]

$175,000.00 FIRE—NO INSURANCE.

Fortunately this great loss is divided among many owners, the greatest loss may not exceed $5,000. Many men fought bravely for hours to conquer the flames, but they did not succeed until hundreds of acres of woods, meadows, fields and hundreds of rods of fence were burned. This is a brief and conservative statement of the annual loss to Indiana farmers, caused by forest fires, most of which could have been avoided. The State Board of Forestry is active in trying to stay this loss. They have had printed on muslin the Indiana Forest Fire law, which provides that one may be fined not less than $5.00 nor more than $50.00 for setting fire to woods, besides being liable for all damages done. These signs are 12 x 18 inches and are to be tacked up at prominent crossroads, etc. They are free for the asking. Address "State Board of Forestry, Indianapolis," stating how many you will tack up.

[Press Bulletin No. 2—Issued December 8, 1909.]

WALNUTS SELLING AT $1.00 PER BUSHEL.

Did it ever strike you that it would be a good investment for the farmer to plant Walnut and Hickory trees along the roadsides, around his dwelling and orchard? Some have already done this and are well pleased with the results. The nuts themselves are a paying crop. Then there is the shade, which is grateful to the stock in the field, and to the horses and men on the road. To travel in the shade on a hot sunny day or to be protected from the strong winter wind by trees is a great benefit to the traveling public. Every one in his heart says what a good man is he who planted the trees. Then the trees are rapidly growing into timber. True the tree takes some substance from the field, but it gets one-half from the roadside, so the owner is paying for only one-half of the raising of the tree. In thirty or forty years a row of Walnut trees along the roadside would be worth far more than the additional amount of grain that could have been grown without the trees. This row of trees makes a farm more valuable and the nut crop will be a steady income.

This fall count how many trees you can plant. Take four times as many hulled nuts, lay them on the ground in a layer in a dry place in your garden, cover them up with a layer of sand, or sand

and dirt to a depth of about two inches. Next spring carefully uncover them, and take the sprouted nuts and plant them. Dig a hole deep and of good dimensions in order to give the tree loose dirt to grow in. Occasionally hoe them during the summer. Better protect them from the stock and plowman. Each year prune them up to a switch until you get a trunk of twelve feet or more, which will make a good log length when cut. Any additional information will be furnished if you will address the State Forester, Indianapolis, Indiana.

[Press Bulletin No. 3—Issued January 6, 1910.]

WHENCE OUR FUTURE TIMBER SUPPLY?

In Indiana not more than 15 per cent. of the original timber supply remains. The question naturally arises, where are we to get our timber supply fifty years hence? No doubt we must follow the example of most European countries and plant forest trees. The State of Indiana was wise enough to see this and nine years ago created a Board of Forestry and has since bought 2,000 acres of land in Clark County upon which to try to grow the different kind of forest trees. This 2,000 acre tract is known as the Forest Experimental Station and is located about 19 miles north of Louisville. At this Station experiments are being tried in growing Black Walnut, Yellow Poplar, White Ash, Hickory, Catalpa, Elm, Oaks, Chestnut, Kentucky Coffee Nut and Locust. It is desired by these experiments to determine the distance apart to plant the different species of trees, the time and amount of pruning, the kind and amount of cultivation, and the adaptability of each species to forest planting. Of course the work has not yet progressed far enough to determine final results. It appears, however, that the native White Ash, Yellow Poplar, Black Walnut and Shellbark Hickory are the most desirable species to plant. These are easy to propagate, grow rapidly, and are free from insect enemies, and are adapted to most all kinds of soil. The Forest Experimental Station can be reached by going to Henryville on the Pennsylvania Railroad, or by going on the Indianapolis and Louisville traction line, and getting off at the Forestry stop. People come from all parts of the State to see the many fields planted with the different kinds of forest trees. Visitors are always welcome to go over the grounds. Persons who anticipate doing much forest planting will be repaid by a visit to the Station. Information on forestry will be cheerfully furnished by addressing "State Forester, Indianapolis, Ind."

[Press Bulletin No. 4—Issued February 10, 1910.]

$40.00 IN PRIZES FOR THE BOYS AND GIRLS.

To stimulate the study of forestry the Indiana State Board of Forestry is offering $40.00 in prizes for the best essays on "Forestry in Indiana." The prizes are to be distributed as follows: $20.00 is to be given the country graded schools, $10.00 to the pupil who sends the best essay from each of the 7th and 8th grades; $20 to the high schools of the State, $10 for the best essay from the freshman and sophomore classes, and $10 for the best from the junior and senior classes.

The essay is limited to 1,000 words and must be in the hands of the Board by May 1st. The Board reserves the right to publish any paper sent in. Besides giving the cash prizes the Board expects to publish the prize-winning papers, which will be sent all over the United States. Any one wishing additional information concerning this contest should write the "State Forester," Indianapolis, Indiana.

[Press Bulletin No. 5—Issued March 10, 1910.]

THE TREE BUTCHER.

The Tree Butcher ruined many valuable shade trees last fall, and it is hoped that he will find steady employment at some other kind of work before spring arrives. Shade trees are usually pruned by some one temporarily out of employment. His only qualification is the possession of an ax and saw. He needs work, so he finds some property owner who has some nice shade trees and importunes him to have them cut back. The owner consents. The axman is to receive so much for the job and the wood the limbs make. The workman at once sees that it is to his advantage to cut the limbs off close to the trunk of the tree, because he can complete the job quicker with no dangerous climbing and by so doing he gets more wood. Consequently the tree is ruined. Shade trees should be trimmed up when young so the top will be at least twelve feet above the walk. After this all that is necessary is to cut out the dead and superfluous branches. The amount and kind of pruning will depend a great deal upon the species of tree planted. When planting it is well to consider how much space you have for a tree and how much light you must have and select the kind of tree that will best fit your case. It is argued that trees should be topped to prevent the limbs from breaking off, and to make them grow thicker. When large limbs are cut off decay soon sets in, and the tree dies. Spare the tree. No one admires a crippled tree. For information on pruning shade trees, write the "State Forester," Indianapolis, Indiana.

[Press Bulletin No. 6—Issued March 22, 1910.]

VALUABLE BOOK FREE.

The 1909 Report of the State Board of Forestry has just been published and is now ready for distribution. This report contains many things valuable to land-owners who anticipate planting some forest trees, or who have eroded or washed hillsides and waste or worn out fields that could profitably be reforested. The *Farmer's Woodlot,* the source of our future timber supply, is given comprehensive treatment. It gives directions for the care, preservation and reforesting the woodlot. It tells you what kind of trees to plant, the distance apart, and the time and amount of pruning to do.

The effect of cutting off the timber from the southern Indiana hills is amply set forth in an article on "The Reforesting the Hills of Southern Indiana." The work of the State Forest Experiment Station is reviewed, and the result of the various experiments are given under the head of "Field Work." A report on several forest plantings shows that forest planting in Indiana if properly managed is a good investment.

Since concrete today is cheaper than wood for many purposes, farmers are advised to substitute concrete for wood fence posts. It is claimed that a post that is strong as wood, and that ought to last indefinitely, can be made for at least 25 cents.

Any one interested in this report can get a copy gratis by addressing "State Forester," Indianapolis, Ind.

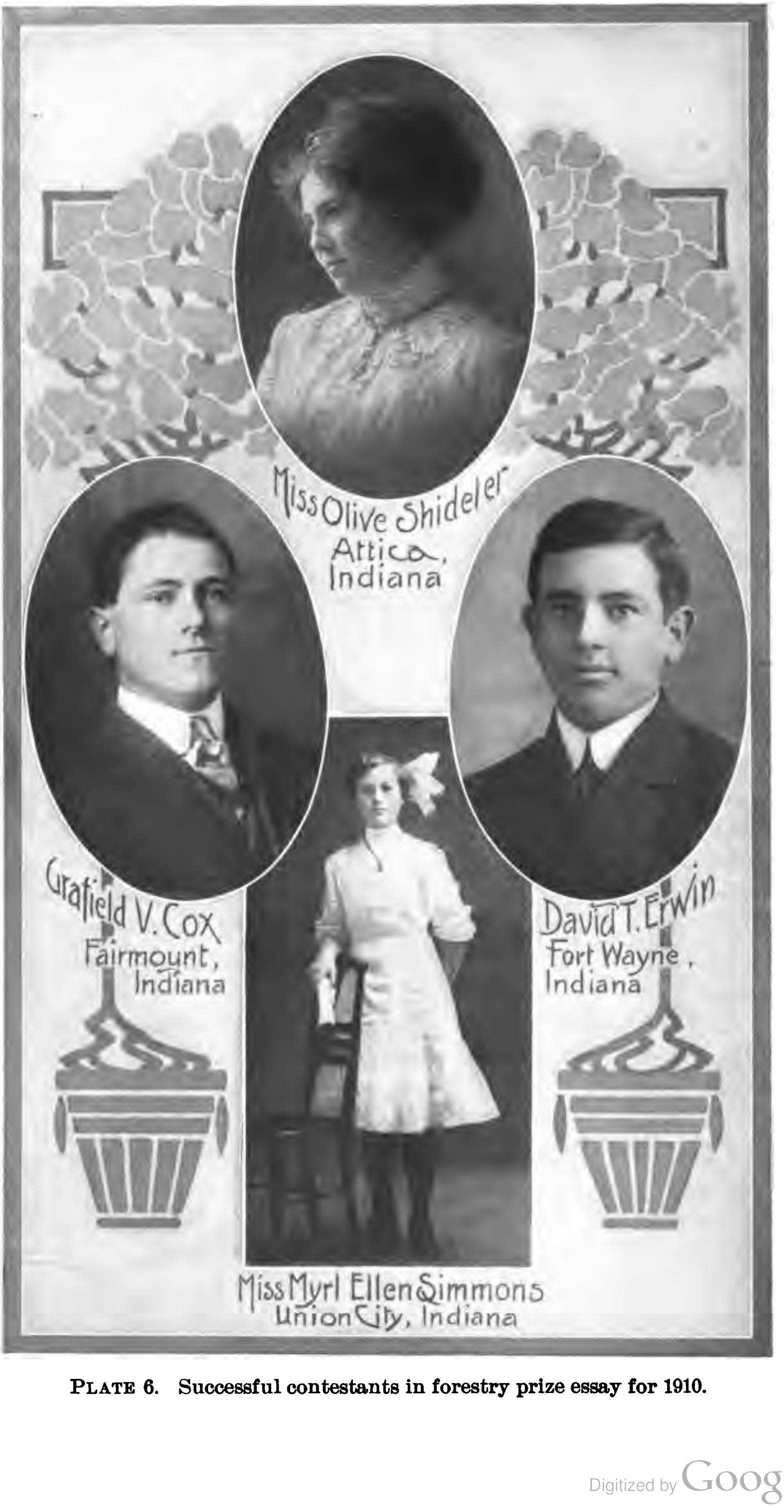


PLATE 6. Successful contestants in forestry prize essay for 1910.

[Press Bulletin No. 7—Issued July 1, 1910.]

PRIZE ESSAY BULLETIN—FORESTRY IN INDIANA.

The subject of forestry is receiving quite a little attention. What is meant by forestry? Often we have in mind one tree and call this forestry, but such is not the case. When we say forestry we must have in mind an expanse of trees sufficiently dense to form an unbroken canopy of tops, and not a scattered growth of trees and shrubs. Some think National Forests consist of large areas of trees which the government is trying to preserve and not permit people to cut down. Others think of forestry as Arbor Day, and a few trees along the streets or lawns.

In order to get the correct idea of forestry before the people of the State, State Board of Indiana Forestry is offering prizes for essays, hoping by so doing to create a greater interest in the subject of Forestry in Indiana, and also to furnish some original thought.

As lumber increased in value people cut down their vast forests, not thinking of deforestation.

More than four-fifths of the State was covered at one time with a heavy growth of hardwood timber. Fine specimens of trees stood in great number and variety everywhere, except on the prairies, which are confined chiefly to the northwest part of Indiana. Several varieties of Oak. Hickory, Walnut, Poplar, Ash, Elm, Beech, Cherry and hard Maple, including many others, comprising in all more than a hundred varieties.

As Indiana became more thickly settled it became necessary to clear the forests so the soil could be cultivated. So much of this was done that one can travel for miles in the State and not see very much timbered land. If such be the case at the present time and no change is made, how much will the coming generation see?

To encourage reforestation each farmer should be granted the privilege of setting aside a certain tract of land to be planted in trees and be exempted from taxation, with privilege of cutting dead any dying trees and replace them with a new plant.

At one time many animals, such as buffaloes, deer, wolves, panthers, foxes, beavers, raccoons, with a great variety of birds and reptiles, were found in the State. As the forests were cleared away the larger animals entirely disappeared and the smaller ones have greatly diminished in number.

We can see that the forests made a home for these animals.

Years ago people thought little of trees for ornament, but now it is quite different.

When we hear the subject of forestry discussed we hear people say the State is becoming so thickly settled that it is not practical to let the forest stand. They say that the demand is so great that all land must be cultivated. In a sense this is true, but let us think if there are not some places in the State that are unfit for cultivation but grow trees nicely. Let us consider the hilly land in the southern part of the State and see what is being done. We will find that they are being interested in this subject.

They are not only planting trees, but protecting them from fires and all forms of vandalism.

The cutting of timber along the river will affect the water supply in some cases, in other cases it doesn't have any effect, but in others it has caused the actual drying up of the streams during certain months of the year.

We have learned that forests are used as a protection in case of storms in different parts of the United States. They not only serve as a protection for buildings and people, but also for all kinds of stock.

The question arises, when, what kind, and how to plant trees? This depends to some extent as to what kind of trees we are going to plant. With most kinds spring or fall planting will be all right. The kind depends on the purpose of the trees.

Trees should be planted about five or six feet apart. After two or three years half of them should be transplanted elsewhere. If left too thick disease and injury will result.

People give little attention to the protection of the forests. If you wish a forest to render the best service there are several things to take into consideration. First is protection, especially against fire, over-grazing and thieves. Second is strong and abundant reproduction. Third is a regular supply or trees ripe for the ax. This can be secured only by the right proportion of each of the small sizes constantly coming on in the growing forests. The fourth is growing space enough for every tree so that the forest as a whole may not only produce wood as fast as possible, but the most valuable sort of wood as well.

The forest, next to the earth, is the most useful servant of man. It is essential to the well-being of mankind. We are under obligations to bequeath to posterity a timber supply.

If we rob the State of all of her beautiful trees and do not replace them with young plants, then we have deprived those that come after us from a pleasure that we have enjoyed. The object of practical forestry is to make the forest render its best service to man in such a way as to increase rather than to diminish its usefulness in the future. Under whatever name it may be known practical forestry means both the use and preservation of the forest.

MYRLE ELLEN SIMMONS,
Seventh Grade, Township Schools, Union City, Indiana.

[Press Bulletin No. 8—Issued July 22, 1910.]

PRIZE ESSAY BULLETIN—FORESTRY IN INDIANA.

The greatest part of Indiana in its primitive state was covered by forests, noble forests, where the Indian in the zenith of his glory hunted the wild game which naturally abounded. The early settler could make little use of the gigantic trees which covered his claim. Of the smaller trees he made his cabin and stable. The latter, with its clapboard roof and puncheon floor, was to him of great value, more than the trees which today would be worth a small fortune.

As the soil was first importance to the settler little thought was given to anything but clearing it of any and all obstructions, so that not even were trees left for beauty or shade—some sugar producers were left. Farms were fenced with rails, and in some places corduroy roads were made by placing logs side by side and covering them with dirt. My grandfather as well as many others worked many a night by the light of a blazing hickory tree to get the new ground ready for corn. It is little wonder the children of the next generation looked upon the tree as a natural enemy, and continued the sacrifice of the forests until it is said that today less than 20 per cent. of the forests remain that existed forty years ago, and lumber has advanced 100 per cent. in the last twenty years.

Much has been said but little has been done about renewing the forests that have been destroyed. The sacrifice of our forests has been accompanied by the rapid development of the agricultural and industrial interests of our State in which cheap lumber has been, and will continue to be, an important factor. Wood will continue, as it has been, to be the most useful of materials for manufacturing and construction. If the forests are destroyed the business interests will suffer the consequences. In January, 1905, the American Forest Congress met in Washington, D. C., to discuss the importance of forest preservation so as to prevent a timber famine. Apparent progress has been made in arousing the people of Indiana to the vast importance, especially the future generation, of that systematic and persistent effort necessary to the realization of the possibilities of the soil and climate of our State in the development of timber resources.

It is important to inculcate in the minds of the youth of our great country a sincere love for nature and a desire to cultivate and protect our trees, because of their usefulness, as well as their beauty and comfort, to mankind. People err who mistrust the willingness of the boy or girl to allow trees to grow unmolested. Farmers, especially, should take up the cultivation of tree growing, not only for appearances, but also for a protection of the animals. Farm dooryards would be much more attractive if they were ornamented with shade trees, for nothing speaks more for the culture of a home or family than well-kept lawns with beautiful trees and vines. It is only humane that live stock should have the protection of the trees.

Many a schoolhouse of Indiana lacks the surroundings that make for contentment and comfort as expressed in the spreading shade trees.

The city school grounds are often so small that tree planting is out of the question and the building is exposed on every side, though where space permits, it is not uncommon to find some of the ground carefully laid out in a good arrangement of grass plots, flower beds and shade trees.

In the country, however, an improved school yard is rarely found and many are as inhospitable as when they formed a part of the unsettled country. This lack of improvement is not due to causes evident at first sight. It is not on account of poverty, because the neglect is as great in wealthy as in less prosperous communities.

It is not due to lack of appreciation of the beauty, for where homes are surrounded with trees, grass and flowers, the school is likely to be neglected. The cause seems to lie rather in the failure to see the importance of comfort and beauty in education and to realize the interest of the young people in the natural world around them. How often is it a teacher of an Indiana common school mentions forestry in any form or helps it along by impressing it on the minds of their children how necessary it is for the immediate conservation of our forests? The Governor of this State annually appoints Arbor Day at the proper season for planting and always gives some valuable points for the benefit of the day. This day is sometimes celebrated in the country school by public exercises appropriate to tree planting, with essays and recitations by the pupils, and probably an address by a visitor, but in a city school little or no time is taken for these purposes. Many people do not know in what month Arbor Day generally comes.

Many cities are rapidly beautifying themselves by the more careful cultivation of plants and trees; for instance our own city, Fort Wayne, has ordered many thousand trees for individuals this spring, which is the result of a Civic Improvement Society. The Pennyslvania Railroad Company has planted over a million and a half of trees since it has taken up forestry on an extensive scale. A certain silk factory has planted over 50,000 pine trees along the streams which furnish water power for them.

How much farther would "Forest Preservation" be carried on if every person felt a little more responsibility toward the saving of our forests and looked forward to future needs. Instead of seeing panic, ruin and destruction staring the people in the face, what might he see: He is a poor American indeed who does not look after the future generation in regards to forestry as well as other important resources.

DAVID ERWIN,
Eighth Grade, Township Schools, Ft. Wayne, Ind.

[Press Bulletin No. 9—Issued July 15, 1910.]

PRIZE ESSAY BULLETIN—FORESTRY IN INDIANA.

A century ago more than four-fifths of our State were covered by an almost unbroken extent of virgin hardwood forest, the quality and usefulness of whose timber was unexcelled. Such were the hardships of the pioneers in clearing away the forests, that they came to regard at as an enemy, the destruction of which was wholly desirable.

Comparatively little of the original forest remains, and that is generally culled and of very poor quality. Throughout the country are isolated wood-lots, fire swept or sodded with grass and heavily grazed, their dead topped and inferior trees making little or no growth. A fire resulting from carelessness swept through a dense wood-lot and entirely killed one of the best stands of vigorous young timber I ever saw. Weeds and grass have covered the land and it is now an unprofitable pasture. As deforestation continues undesirable changes in climate result, and floods and land erosion become increasingly severe. Among the hills, streams swollen by heavy rains rush quickly into the Ohio. The flood subsides, the volume becoming so small as to seriously impair navigation, and leaving bars of sediment in the channel. Much the same may be said of the Wabash, though the character of its basin tends to ameliorate the evils attending forest destruction. I have seen steep, gravelly hillsides, after the removal of forest cover, so washed and gullied as to render them useless. The fertile lowland and stream beds received the deposit of rocks and sterile soil. The underground water level has lowered and springs flow only during rainy periods.

The cost of building material alone emphasizes the necessity for wood. Trees grow; mineral substances do not. Therefore, other materials can not take the place of wood in our civilization. Through diminished supply the importation of timber must largely cease in the near future, and then we must face the problem of home production. In central Indiana, with which region I am best acquainted, the hardy catalpa seems capable of great possibilities. No native wood is more durable, or better adapted to a great variety of uses. I know of a catalpa which grew without cultivation to a diamater of fifteen inches in as many years. They should, however, be grown in good soil, and receive thorough cultivation, and pruning for two years. The catalpa proves a failure in heavy clay soil. The value of older groves proves it to be as profitable as any staple farm crop. No enemies have attacked it in this region. The black locust is the catalpa's equal in many ways, but the borer has rendered its growth impracticable.

With a few exceptions, mainly in the hills of southern Indiana, the remaining woodland is in the form of farm wood-lots. From these our future timber supply must largely come. I hear many farmers say, "The wood-lot doesn't pay." This is probably true, for I do not know of one properly managed wood-lot in this region. With some extra labor and considerable thought, it may become profitable; no more by creating income than saving expense. Few realize the dependence of the farm upon its wood-lot. When grazing is prohibited and fire kept out, nature accomplishes wonders in the way of reproduction. As the high value of land makes intensive farming necessary to secure profit, so does it make care and cultivation necessary for a profitable wood-lot. The plan of wood-lot management is simpler, and the profit greater than that derived from larger areas. Dead, dying or imperfect trees, and undesirable species should be removed. All trees should be cut with a low stump, and felled in a way to injure as little growth as possible. Leave seed trees of good kinds, and in open spaces plant the seed or seedlings of the best species. I believe the yellow poplar, black walnut, and white ash are the most profitable trees for the wood-lot. The white ash thrives better on poor soil than the two former. The chestnut oak thrives better on thin hill land than other oaks. The wood-lot should be kept as dense as proper development of the trees will permit, and the ground should be covered with leaf mold. Given such care as I have mentioned, the growth of young trees will surprise those who consider the production of valuable timber a matter of centuries.

Many claim wood-lots should be exempt from taxation. To succeed, forestry must be profitable. Therefore, woodland should be taxed, though much excellent timber has been cut or destroyed, because taxes were too high. I believe properly forested land should be free from taxation, or very lightly taxed until such time as it may yield an income.

I do not believe private enterprise will sufficiently reforest the hill land in our southern counties before great loss results. Therefore, the State should establish protective forests where they are most needed.

The education of the public is the first great step toward the final goal. With public sentiment the work will succeed; without it, it will be a signal failure. The State and the government should distribute instructive literature on the subject throughout the country. Our State Forest Reserve has had an excellent influence by educating the public through practical demonstration. It would be true economy for the administration to establish reserves in other portions of the State. The State press should actively advocate forestry, and aid in disseminating knowledge on the subject. The real value of our woodland should be impressed upon the minds of public school pupils.

We have discussed conditions as they are, and suggested both the way to perpetuate our native woodland, and the means of interesting the public in the work. Let us not too severely condemn the action of our pioneer fathers, but strive to do our duty toward posterity as fully as they did theirs.

GARFIELD V. COX,
Sophomore Class, Faimount H. S., Fairmount, Ind.

[Press Bulletin No. 10—Issued July 20, 1910.]

PRIZE ESSAY BULLETIN—FORESTRY IN INDIANA.

As the civilization of a nation is measured by her progress in Forestry, just so is the progress of a state measured by the way in which it handles this problem. Measured by this standard, Indiana does not rank so high as when measured by the intellectual standard.

The "awakening" in our Hoosier State came later than in many others, because the forest being very dense, in early days, was the Pioneer's enemy, and it is in this light that a large part of the present generation are inclined to regard it. Though slow in beginning, Indiana now has the institution of Forestry on as firm and practical a basis as any State in the Union.

This problem, as it confronts Indiana, is not the difficult one that confronts many western States. Here it is simply a problem of planting, cultivating and waiting. Nevertheless, Forestry, in any locality, is a gigantic question, and one in the interest of which the State, corporations and people must work together.

The future prosperity of this State depends upon the maintenance of its varied industries, a large number of which depend directly upon the forest products. Many of these industries are already importing timber from other States, while statistics show that before long many will be forced to discontiinue operations through lack of materials.

Much deforesting has been done by wastefulness, but the day is coming when every foot of timber will be utilized. The trees will be cut nearer the ground, while even the tops will be used. By a chemical preparation lately discovered, wood may be made to last much longer and be more durable, than in its natural state. In this way some of the soft woods may be made to take the place of the valuable hardwoods for posts and cross-ties. A change has come none too soon, for the virgin growth of hardwood is virtually gone, and all hardwood obtained henceforth will be second growth stuff.

A few years ago the State bought two thousand acres of land at eight dollars per acre, near Henryville, in Clark County, about twelve hundred acres of which was covered with second growth timber. In purchasing this land the State purposely selected waste land. It was thought best to try reforesting this land, and thus prove that it could be put to good use. The legislature has, at various times, appropriated money for improvements there, but it is the plan of the State Forestry Department to make this reservation self-supporting. Experiments in planting and cultivating are taken up here under competent foresters. The reservation would eventually be a paying proposition to the State as an experiment station, if it were never to yield a cent of money, for it is from facts gleaned here that the citizens of Indiana are to know what trees to plant, and how to care for them. The State hopes that through the agency of the reservation much of the land hitherto abandoned may be put to some practical use. Since this land was unfit for cultivation for agricultural purposes, it seemed more profitable to let the State have it than pay taxes on it, after the timber had been removed, but this has not proven true in the long run, because these lands have become a menace to the State. The bare soil was subject to erosion, and much good soil was covered over with this silt. Among the rivers of Indiana that were navigable in time past, not one is to be found that is of any importance as an inland waterway today, because they have been filled with sediment from eroded lands. The deforesting of lands along streams has caused greater and greater floods each year, until bottom lands that were once very fertile and had a deep soil, are today almost worthless. Farm after farm, in southern Indiana, considered valuable thirty years ago, is practically deserted today.

The Wabash Valley has been stripped of its valuable timber to the very banks of its river, and what is true of that section is true of all timber sections of Indiana. Aside from a mere money consideration, it would seem that the beauty of the State should be considered, and it is certain that the latter has not been enhanced by the destruction of the forests.

This is the existing condition, but the question is: How can it be bettered? It is clearly a problem of reforesting, yet it is a difficult question how best to bring this about. What to plant and how to care for it baffles many, but the State stands ready to advise them. The State Forestry Department publishes much literature on this subject, which may be obtained for the asking.

Let each farmer consider his wood-lot in the light of its future value, rather than its present use, for it is largely from these that the future timber supply must come. It is not necessary to have a large tract given over to reforestation, rather a small one, well cared for. To do this means to relieve it from pasturage, make the proper cleanings and thinnings, and thorough protection against fire. Land planted in forests is a good investment, though people do not realize it. After considering the value of timber, it seems unnecessary to exempt forest lands from taxation. The only thing, it is a long investment, and for this reason, can be better handled on a large scale, by corporations than individuals. Many of the railroads are planting their lands, to produce their own supply of cross-ties. However, the State should not depend too much upon its citizens. Other countries are reforesting large tracts, so why should not ours?

After all has been said the subject of forestry is largely a matter of education. This movement will never be opposed by the strongest thinking people; therefore the future advancement of Forestry in Indiana depends upon the proper education of her citizens, both young and old.

OLIVE O. SHIDELER,
Senior Class, Attica High School, Attica, Ind.

The prize essay bulletins were issued too late in the school year to be used by many of the schools. Yet the result was a surprise to the Board. Pupils, teachers and superintendents entered heartily into the contest, which resulted in an increased study and investigation of the subject of forestry in Indiana. The results were so gratifying that the Board decided to duplicate the prize essay offer for 1911. The subject of the 1911 essay is to be "To what extent should Indiana be reforested; give reasons." A bulletin announcing this fact was mailed in October, 1910.

Field Work.

This consists in visits of inspection to forest plantings and woodlots. There are a few requests for forest inspection, but the majority of the visits are made without previous request. These visits have a twofold purpose. First, to give the owner suggestions as how best to manage his planting or woodlot. Second, to collect and tabulate information relative to forest plantings. At present the area and locations of the many forest plantings of the State are not known. When the 1910 statistics were taken, the secretary succeeded in having the following question placed on the blanks: "How many acres of cleared land planted to forest; number of trees?" From the answers to this question it was hoped to gain an accurate idea of the extent of afforesting in Indiana, and also learn in what part of the State the work was being done.

The statistical books are on file in the office of the county auditor and it is an easy task on visiting the county seat to go over these books, and secure the area and location of every forest planting in the county, as well as the name of the owner.

The result of this question was a miserable failure. A great many of the assessors failed to do their duty. Some entirely neglected it, and others thought it referred to the repealed law, exempting woodlots from taxation. The last-named assessors returned a list of woodlot owners. So after all it is only a question of conjecture as to how many forest plantings there are in the State, or the acreage planted to forest. No doubt the number reported by the statistical returns will be below the true number. The records of over twenty counties have been examined, and one county which reported no forest plantings is known to have at least twelve.

Area of Indiana in acres	22,403,502
1852. Acres of improved land	5,046,143
1877. Acres of improved land	10.107,816
1880. Acres of timber land	4,335,191
1881. Acres of timber land	4,821,303
1882. Acres of timber land	4,585,012
1883. Acres of timber land	4,412,608
1884. Acres of timber land	4,428,581
1885. Acres of timber land	4,379,759
1886. Acres of timber land	4,000,606
1887. Acres of timber land	3,764,679
1902. Acres of timber land	3,847,042
1908. Acres of timber land	4,361,667

1902.	Acres of first class timber	250,080
1902.	Acres of second class timber	843,506
1902.	Acres of third class timber	2,753,456
1902.	Acres in timber not pastured	1,223,337
1902.	Acres in wood pasture	4,428,362
1902.	Acres of waste land	367,416
1902.	Acres of broken waste land	692,738
1902.	Number of forest trees planted and cultivated	105,675
1908.	Acres of woodland in pasture	2,434,017
1908.	Acres of woodland not in pasture	1,927,650
1910.	Acres of woodland in pasture	2,507,875
1910.	Acres of woodland not in pasture	1,964,134
1910.	Acres of cleared land planted to forest	2,483
1910.	Total number of forest trees planted	1,972,661

The preceding statistics are very misleading. An examination shows that in 1910 there were one hundred and thirty-six thousand more acres in timber land than there were in 1880, thirty years before. Some lumber dealers, sawmill owners and lumber buyers, who have been acquainted with the timber supply of the State for the past thirty years, have been asked to estimate the supply in 1910, as compared with 1880, and the answers range from ten to twenty-five per cent. If twenty per cent. be taken as an average, the present supply based on the statistics of 1880 would be less than nine hundred thousand acres, or about one acre of good timber land to every twenty-eight acres of cleared land.

An explanation of this apparent discrepancy is found in the fact that formerly timber land was woods from which no valuable trees had been removed. Clearings and cut-over woods were not included. In later years when the statistics were taken, all kinds of woodland were included under timber land. In the 1910 statistics "woodland not in pasture" only can be ranked as timber land. "Woodland in pasture" means woods from which all or most all of the valuable trees have been removed, and the stand is so thin that it is now used as a pasture field.

One reason there were not more requests for forest inspections was that the land owner did not know that the services of an inspector were available. Invariably the owner of the planting welcomes the inspector and in most cases is in need of advice which, however, in many instances comes too late. His instructions as to what species of trees to plant and how to plant and manage them were received from the man who sold him the trees, who in many cases does not give either correct or complete instructions.

The following is a list of the plantations visited during the fiscal year, showing location, owner, species and area, or number of trees planted.

County.	Town.	Owner.	Species.	Trees.	Acres.
Adams	Berne	Teeter, Calvin	Catalpa	800	
Adams	Berne	Ryb, Alfred	Catalpa	800	
Adams	Geneva	Long, R. R.	Catalpa	500	
Dearborn	Moores Hill	Morrow, Stanton	Locust		20
Dearborn	Moores Hill	Stevens, Frank S.	Locust		1
Delaware	Daleville	Fenwick, C. P.	Catalpa	500	
Delaware	Daleville	Rinker, Henry	Catalpa	500	
Delaware	Daleville	Shoemaker, Joseph	Catalpa	500	
Delaware	Daleville	Shoemaker, Arthur W.	Catalpa	4,000	
Delaware	Yorktown	Helvie, W. M.	Catalpa	1,600	
Elkhart	Goshen	Nye, P. F.	Catalpa	3,000	
Fountain	Newtown	Aiken, Elias	Catalpa	2,024	
Gibson	Pierceton	Brown, Arthur F.	Catalpa	2,500	
Gibson	Pierceton	Pumphrey, John	Locust	1,000	
Gibson	Pierceton	Swissler, John A.	Catalpa	1,350	
Henry	Knightstown	Kerwood, Wayne	Catalpa	500	
Henry	Knightstown	Williams, Chas.	Catalpa	450	
Henry	Dunreith	Adams, S. B.	Locust		2
Henry	Spiceland	Holtsclaw, James D.	Catalpa		3
Jay	Blaine	Ertel, A. S.	Catalpa	25,000	
Jay	Blaine	Hudson, S. E.	Catalpa	25,000	
Jennings	Vernon	Leavitt, J. E.	Locust		92
Jennings	Vernon	Rogers, Geo. A.	Locust	50,000	
Kosciusko	Pierceton	Andreas, J. L.	Catalpa	6,000	
Kosciusko,	Pierceton	Pennsylvania R. R. Co.	Catalpa	35,000	
Knox	Vincennes	Bierhaus, John	Locust		1
Knox	Vincennse	Boyd Brothers	Locust		7
Knox	Vincennes	Simpson & Son, H. M.	Locust		2
Lagrange	Lagrange	Woodworth, F. R.	Locust	1,000	
Lagrange	Lagrange	Woodworth, F. R.	Catalpa	1,000	
Lagrange	Lagrange	Woodworth, F. R.	R. Mulberry	1,000	
Lagrange	Shipshewanna	Bontrager, L. J.	Catalpa	3,000	
Lagrange	Shipshewanna	Weaver, Wm.	Catalpa		5
Lagrange	Topeka	Black, Wm. H.	Locust	1,600	
Lagrange	Topeka	Fought, Amos	Catalpa	1,500	
Lagrange	Topeka	Fought, Fletcher	Catalpa	1,000	
Lagrange	Topeka	Lantz, E. C.	Catalpa	1,000	
Lagrange	Topeka	Neufer, S. S.	Locust	500	
Lagrange	Topeka	Neufer, S. S.	Catalpa	500	
Lagrange	Topeka	Ollinghouse, Elias	Locust	600	
Lagrange	Topeka	Ramer, Chas.	Catalpa	600	
Lagrange	Topeka	Yoder, D. J.	Catalpa	800	
Lagrange	Topeka	Yoder, M. A.	Catalpa	500	
Lagrange	Topeka	Yoder, M. A.	Locust	1,000	
Lagrange	Wolcottville	Young, David	Catalpa	1,000	
Lagrange	Wolcottville	Young, David	Locust	1,700	
Marshall	Plymouth	Kline, Geo. W.	Catalpa	2,100	
Miami	Warsaw	Woodward, W. J.	Catalpa	1,000	
Montgomery	Wingate	Coen, J. E.	Catalpa	2,100	
Montgomery	Wingate	Coen, J. E.	Ash	400	
Montgomery	Wingate	Coen, J. E.	Walnut	600	
Morgan	Mooresville	Dow, William	Walnut		2½
Noble	Avilla	Kelham, Thos.	Catalpa	4,000	
Noble	LaOtta	Bilger, Geo.	Catalpa	900	
Noble	Ligonier	Mawhorter, T. J.	Catalpa	2,000	
Noble	Rome City	Schermehorn, J. M.	Catalpa	1,000	
Noble	Rome City	Weaver, Will	Catalpa	1,500	
Parke	Tangier	Whittington, J. M.	Catalpa	3,000	
Parke	Silverwood	Whitford, McCoy	Catalpa	3,000	
Parke	Silverwood	Sturm, Melvin	Chestnut	2,339	
Posey	Mt. Vernon	Erwin, Thos. J.	Chestnut	1,200	
Posey	Mt. Vernon	Erwin, Thos. J.	Catalpa	2,500	
Posey	Mt. Vernon	Ludlow, Abe	Locust	5,100	
Posey	Mt. Vernon	Jefferies, Jas.	Catalpa	1,000	
Posey	Upton	I. L. Coen	Locust	23,000	
Putnam	Greencastle	Hazelett, Samuel	Locust	10,000	
Putnam	Greencastle	Hazelett, Samuel	Catalpa	2,000	
Randolph	Winchester	Brown, Lucinda	Catalpa		3
Ripley	Morris	Weisenbach, Joseph	Catalpa	1,000	
Ripley	Morris	Weisenbach, Joseph	Locust	7,000	
Ripley	Versailles	Gordon, Jos. E.	Locust	20,000	
Rush	Carthage	Hall, Wm.	Catalpa	2,000	
Spencer	Gentryville	Hemenway, Mr.	Locust		10
Spencer	Gentryville	Mason, Mr.	Locust		30
Spencer	Gentryville	Roberts, E. E.	Locust	4,000	
Spencer	Gentryville	Roberts, E. E.	Catalpa	1,000	
Spencer	Hatfield	McCoy, R. L.	Locust		2
Spencer	Lake	Bauman, Andy	Catalpa	1,600	
Spencer	Lake	Jolly, W. E.	Catalpa	1,000	

County.	Town.	Owner.	Species.	Trees.	Acres.
Sullivan	Sullivan	Durham, James J	Catalpa	2,000	
Sullivan	Sullivan	Wibel, Chas. L	Catalpa	1,200	
Sullivan	Sullivan	Woodward, John	Catalpa	500	
Sullivan	Sullivan	Wilson, Frank	Catalpa	1,000	
Sullivan	Sullivan	Burnett, W. H	Catalpa	700	
Sullivan	Sullivan	Burnett, C. E	Catalpa	1,300	
Vermillion	Cayuga	Porter, Harry Q	Walnut		1
Vermillion	Clinton	Hedges, Noah	Catalpa	1,000	
Vermillion	Clinton	Shrew, Lysander	Catalpa	1,000	
Vigo	Terre Haute	McKeen, Riley	Catalpa		25
Vigo	Sanford	Strole, Joseph S	Catalpa	1,700	
Wayne	Richmond	Hunt, Wm	Catalpa		4
Total				296,063	210½

Number of plantations visited, 91.

When a planting is visited, a regular list of questions is asked. Of course it is not always possible to get answers to all of the questions, for frequently the one who has full knowledge of the planting is not at home, may be dead, may have moved away or may have forgotten the information. The following is a list of questions asked, to which is added in the first column the extreme answers in all the plantings visited, and in the second column the average:

PLANTATION MEMORANDA.

	Extreme Answers.	Average.
Name of owner		
Address		
Location of Plantation		
Value of land	Catalpa $30 to $100 Locust $10 to $100	Catalpa $76. Locust $52.
Soil		
Drainage		
Water level		
Number of acres planted		
Total number of trees planted		
Number of Catalpa planted		
Number of Black Locust planted		
Number of..................planted		
Present stand		
Size of seedlings planted	6 to 48 inches	15 to 22 inches.
Seedlings were purchased of		
Price per thousand	Catalpa $4 to $30 Locust $1.65 to $22	Catalpa $16. Locust $5.89.
Ground was prepared before planting		
When planted		
Trees are spaced	Catalpa 3–64 sq. ft. Locust 9–36 sq. ft.	Catalpa 29 sq. ft. Locust 20 sq. ft.
Cultivation		Catalpa 98%. Locust 82%.
Undercropped		Catalpa 64%. Locust 33%.
Pruning		Catalpa 85%. Locust 60%.
Injury by insects		Catalpa sphinx 49%. Locust borer 65%.
Injury by rodents		
Amount and kind of pasturing done		
Average height		
Average circumference (at 4½ ft.)		
Circumference of largest		
Mistakes made		
Above information given by		
Date of inspection		
Remarks		

A review of the data given on the above tracts reveals some interesting and almost startling facts. The answers to a majority of the questions asked will be considered again.

Value of Land.—It is found that in practically all instances the purpose of forest planting is to grow timber for fence posts, hence catalpa and black locust are planted. A majority of land owners are influenced to plant by nursery salesmen, who frequently exaggerate the profits of a forest crop. The agent induces the farmer to plant catalpa, and suggests that he use his best land for the purpose because the catalpa demands a rich black loam soil. Little or no thought is given to utilizing the nooks and corners for forest planting, which are really waste land. Hence the average value of the land on which catalpa is planted is $76.00. The average value of land on which black locust is planted is $52.00. This is because many of the locust plantings are in the south part of the State on eroded and waste land. Some forestry progress is noted among some of the land owners of the broken and hilly parts of southern Indiana. Some are not only planting the eroded cleared fields to locust, but are dibbling in forest seedlings along the banks of ravines. In a few years the wisdom of such plantings will be apparent to adjacent land owners and they will do likewise.

Persons who expect the immediate conversion of the multitude of land owners to afforesting their lands will be doomed to disappointment. The poor land owner of the south will not be moved by the utilitarian argument that he will be a hero and show his patriotism by reforesting his hillsides to increase the water supply of the country. He prefers to be a spectator and let the other "feller" do it. Neither will he be moved by the aesthetic argument. The few hills and valleys he owns are his only source of livelihood, and he will not plant his hillsides and ravines until a demonstration convinces him that a forest crop will be more profitable than grazing or farming. Then, as frequently is the case, the work must be postponed for lack of capital. He does not have the money to plant, and he dares not deprive himself of the meagre income the hills yield until a forest crop matures.

In Indiana there are thousands of acres of waste land that could be profitably planted to forest. It is on these areas that it is advised to plant suitable species.

Soil.—The catalpa is found planted on almost all kinds of soil. The soil best adapted to catalpa is a black or clay loam with good under drainage. It will endure winter inundations without apparent ill-effects. Even summer inundations of short duration will not kill it. Trees planted in drained peat bogs do not thrive. Catalpa planted on very sandy or gravelly soil grows very slowly, as indeed do most other species.

The soil best adapted to the locust is a dry soil. In the low black loam with considerable humus it will die, while the catalpa will grow fairly well. The locust grows most rapidly on the hills and in the ravines of southern Indiana.

Size of Seedlings Planted.—The size of the seedlings planted is usually 12 to 18 inches in length, which is, no doubt, the most desirable size of plant. Larger seedlings cost more and are more expensive to plant, and, as is frequently the case, the root system of large trees is less in proportion to the top than the smaller ones, it is necessary to top them back or run the risk of having them die.

Seedlings Were Purchased of.—This question develops the fact that some nurseries sell better stock than others. Nurseries that gather their own catalpa seed in the lower Wabash Valley are selling catalpa seedlings nearer to the true speciosa than nurseries relying upon the trade for their stock of seed. A majority of the catalpa plantings visited were not old enough to show the characters which distinguish the species. Of the plantings that were old enough, not one in ten was catalpa speciosa Ward. The others were hybrids, or true bignonioides Walt. See plates 7 and 8, which are photos of the Catalpa speciosa.

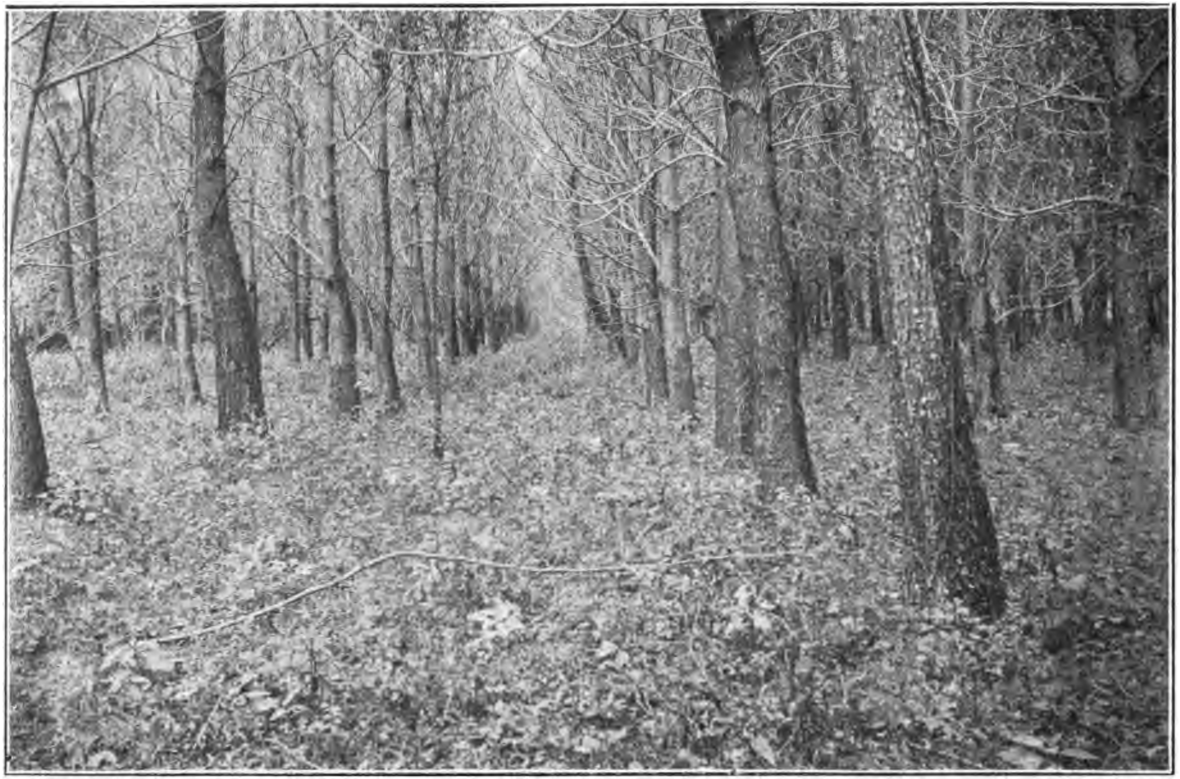


PLATE 7. View in Catalpa planting of Wm. M. Hunt, to show how slow the Catalpa self-prunes. Contrast growth with the Black Walnut shown in Plate 10.

Price Paid for Seedlings.—The price of catalpa seedlings varies from four to thirty dollars per thousand and they ought to be sold for less than ten dollars. Planters who buy from agents invariably pay a high price. Planters are advised to buy seed and raise their own seedlings. When you buy seed you have a strong character, indicating to what species the seed belongs. Catalpa speciosa seed can usually be bought for two dollars per pound, which under favorable conditions will propagate seven to ten thousand seedlings. The seed should be sown in the spring, about corn planting time, in rows about three feet apart. The seed should be drilled in very shallow furrows, about fifteen to twenty to the foot, and covered one-half to one inch with earth. The seed should be sown in a sandy loam soil. A compact soil will not do, because frequently a rain will so pack the surface that the germinating seeds will not be able to break through. After the seedlings are up, successive cultivations are all that is needed.

Locust seedlings are usually bought for a price nearer what they are worth. Locust seedlings 12 to 18 inches long are sold for two dollars and fifty cents to five dollars per thousand, depending upon the quantity purchased. Here again the planter can save money by raising his own seedlings. The seed usually costs about fifty cents a pound. It is better to gather the seed from near by trees that have never been attacked by borers. A pound contains approximately thirty-two thousand seeds, which under favorable conditions will start about fifteen thousand seedlings. Locust seed should be planted in the fall or spring in loose soil in rows about three feet apart. Drill the seed in shallow furrows about fifteen to twenty to the foot and cover them with earth to a depth of three-fourths of an inch. Before planting, the seed should be immersed in a wooden bucket of hot water for about ten hours, or until the seeds show signs of germination. The temperature of the water should be about 160 degrees Fahrenheit, or slightly lower than that used for scalding hogs when butchering. The seed should be planted at once after soaking, and not be allowed to become dry.

Preparation of Ground.—In all the plantings visited where the character of the surface would permit, the ground has been prepared before planting, as for corn.

When Planted.—In all cases but one the planting has been done in the spring. Many of the trees in the planting that was done in the fall had been upheaved by frost. It is advised to plant in the spring just before corn planting time.

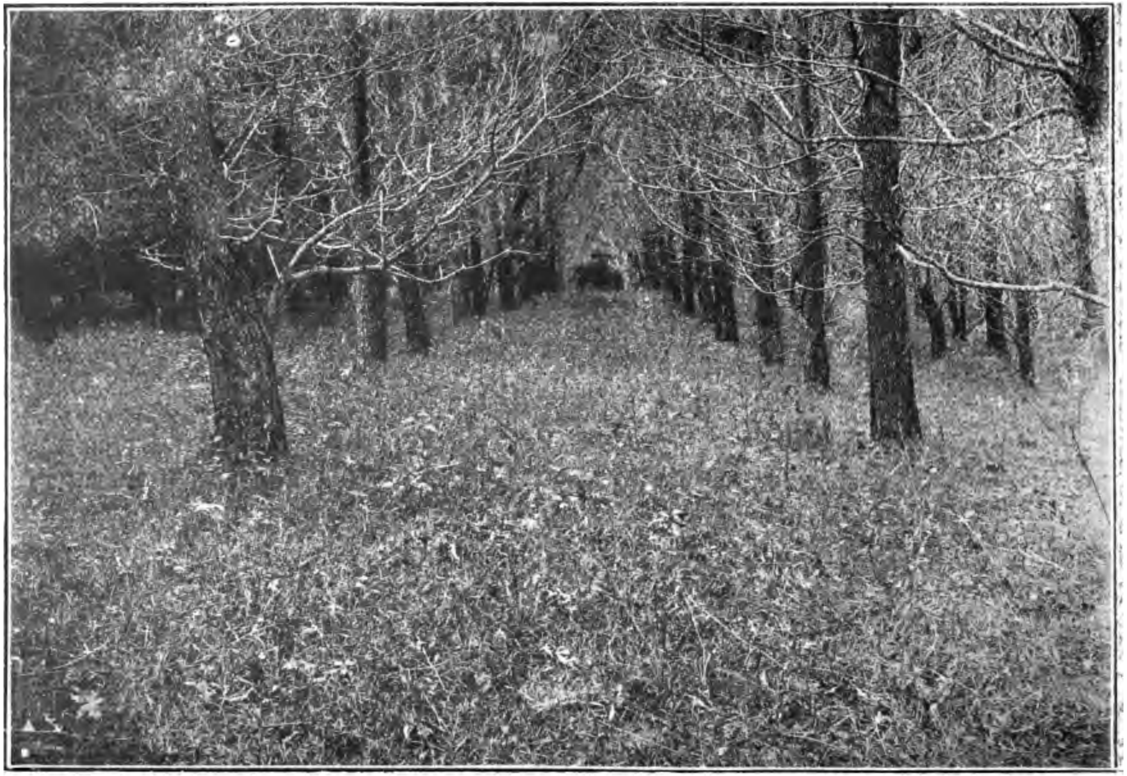


PLATE 8. Catalpa planting of Wm. M. Hunt, near Williamsburg, showing neglect of early pruning. Trees planted in 1878 and spaced twelve by fifteen feet.

Plate 9. Black Walnut planting of Wm. Dow, 4½ miles southwest of Mooresville. Trees spaced 8 x 10 feet, planted about 35 years ago. Average circumference 27 inches. One of the largest is 38 inches in circumference with a clear bole of 30 feet.

Trees Are Spaced.—There is quite a difference of opinion as to the proper spacing of both catalpa and locust trees. The argument for close planting is that the trees will grow straighter and prune themselves. This class of planters are willing to sacrifice everything for these two points. The arguments for wide spacing are that the initial cost is much less for seedlings and of planting. The wide spacing permits undercropping and cultivation. That the value of the undercrop will in many cases in one year pay for the seedlings, cost of planting and cultivation. That the trees will grow much more rapidly when both the root system and crown have plenty of room. That when thinning is necessary the product can be marketed with less expense.

In good soil, for the close planting of catalpa, four by four feet or five by five feet is advised, for wide planting eight by eight feet.

What has been said concerning the spacing of catalpa is also true of locust, except that the maximum distance of planting should be reduced to seven by seven feet.

Cultivation.—All the catalpa plantings visited, but one, have had one or more cultivations. Cultivation is advised where the surface will permit. See results in tract No. 33, page 34. If the trees are planted too close to use corn as an undercrop, and there is not too much shade, pumpkins may be used. They will stand shade and grow in more weeds than any other crop.

Pruning.—Many planters think there is no need for green pruning in a forest crop. They plant close and let nature do the work. Those who expect to prune usually neglect it, especially after the third, fourth or fifth year.

In the case of the catalpa, if it is to be coppiced it should not be done until the tree is about one and one-half inches in diameter at the ground. Coppice work should be done some time between November 1st and April 1st. The coppice scythe is the best instrument with which to do the work. The coppice scythe is a tool of recent introduction, the blade of which is about eight inches long and the shape of the mowing scythe blade. The blade can be purchased for about fifty cents, and can be attached to the snath of any mowing scythe.

If the trees are not to be coppiced all the strong side branches should be pruned off and all but one of the terminal leaders removed. See plates 7, 8 and 9. If time will permit it is advised in June, when the terminal shoots are about a foot long, to go over the

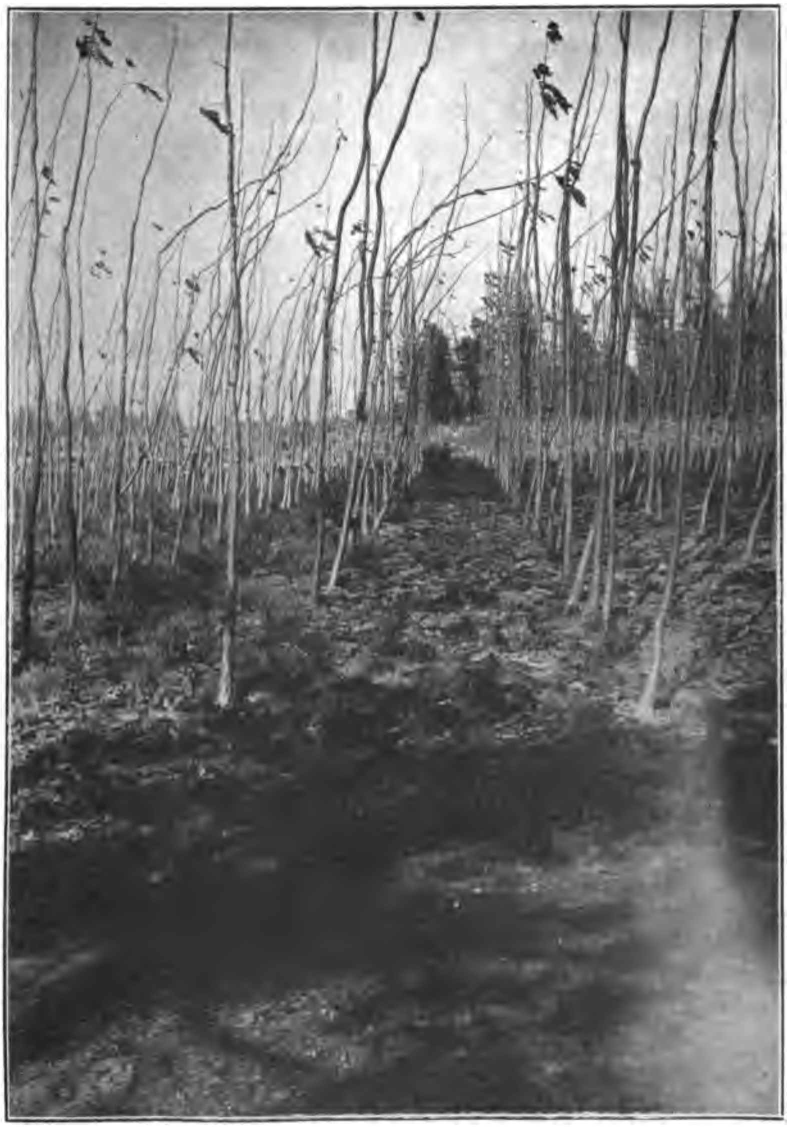


PLATE 10. Shows excessive pruning of Catalpa.

tract and remove all the terminal shoots but one. If several terminals are allowed to grow during the entire season the direction of growth of each will be more diverging, and the wound made by removing the surplus ones at the end of the season will be so large that it damages the tree. Plate 10 shows the excessive pruning of catalpa. In this planting all the leaves and branches were stripped off except a few at the top of the tree. The trees were planted spring of 1905, spaced 4 x 6, average circumference six inches at breast height in fall of 1910.

The pruning of black locust should be restricted to the removal of very strong side branches and surplus terminal leaders. The small side branches on locust should not be removed. They assist in adding diameter to the tree and will soon shade off.

The owners of a few locust plantings did not prune because they believed it invited the locust borer. It is believed that extended observations will refute this idea.

Of course in all pruning work the branches cut off should be removed as close as possible to the axis of support.

Injury by Insects.—The larvæ of the catalpa sphinx has very greatly damaged some of the catalpa plantings. The catalpa sphinx is not a new pest, because it has been in the lower Wabash Valley as long as the oldest settler can remember. It has followed the catalpa plantings as far north as Daleville, in Delaware county. In the southern part of the State there are two broods of this moth, the first appearing the latter part of June and the second appearing the latter part of August. North of Indianapolis only the August brood has been noted. The only way to get rid of this pest is to spray the trees with some arsenical, such as Paris green. The larvæ of two plantings visited were heavily parasitized, which apparently has little effect, since both plantings have been defoliated for several years. The larvæ at maturity drop to the ground and pupate in the earth near the base of the tree. Chickens greedily devour the larvæ, and one planter was found who would shake the trees in the morning until the appetite of his chickens was satisfied. Hogs turned into the planting after the larva have pupated will greatly reduce the number of pupæ.

Twice defoliating the catalpa trees does not kill them, but greatly reduces the annual growth.

In Adams county the one-year-old planting of Alfred Ryf was invaded by grasshoppers, which not only ate the bark off the trees but ate from one to three-eighths of an inch of the woody fibre. The grasshoppers showed a preference for the stem of the trees, since the leaves were not eaten.

Late last fall in the planting of Jacob Frantz, in Wells county, the snowy tree-cricket deposited its eggs in the petioles and terminals of the trees of a two-year-old catalpa planting. The terminals were killed and it was necessary to cut them back of the injury, which in many instances was a foot in length.

Four insect enemies of the locust tree have been noted in the State the past year, two of which, the leaf miner and twig borer, have caused but little injury.

In the plantings of George A. Roberts and J. E. Leavitt, of Vernon, the bag worm had partially defoliated many of the trees. Many of the trees in the planting of Mr. Rogers, which is three years old, would average twenty-five cocoons to the tree. See plate 11. This pest appeared for the first time in this planting last year, and has not spread much this season. A majority of the bags were attached to the branches by a band which extends around them. This year's growth of the tree has not been able to break this band, which resulted in a constriction of the branch, as shown in plate 12. It is evident that the tree will suffer a severe pruning from the effect of these constrictions.

The locust borer is the most vital enemy the tree has, and is found in all parts of the State. It was found in all the plantings visited that contained trees large enough to be attacked by the borer. It may be safely asserted that it is hazardous to set locust plantings in any part of the glaciated region of Indiana, except in the lower Wabash Valley.

In the northern part of the State locust plantings are severely attacked, and many of the trees are ruined. In the southern part of the State the borer is not so destructive. Locust may be planted with little fear of being badly damaged in the first two or three tiers of counties north of the Ohio river. There are isolated areas north of these counties in which the borer has not yet appeared in destructive numbers.

In growing the locust it is advised to plant seedlings raised from the seed of trees that grow in the neighborhood where the seedlings are to be planted, and gathered from the trees that have never been attacked by the borer.

Injury by Rodents.—In a few catalpa plantings rabbits have severely injured the trees by gnawing off the bark. One one-year-old planting was so badly injured that the whole had to be coppiced. Mice do little damage.

Pasturing.—In a majority of the plantings no pasturing has been done. What little is done is among the larger trees. Frequently the shade of the older catalpa plantings is utilized by turn-

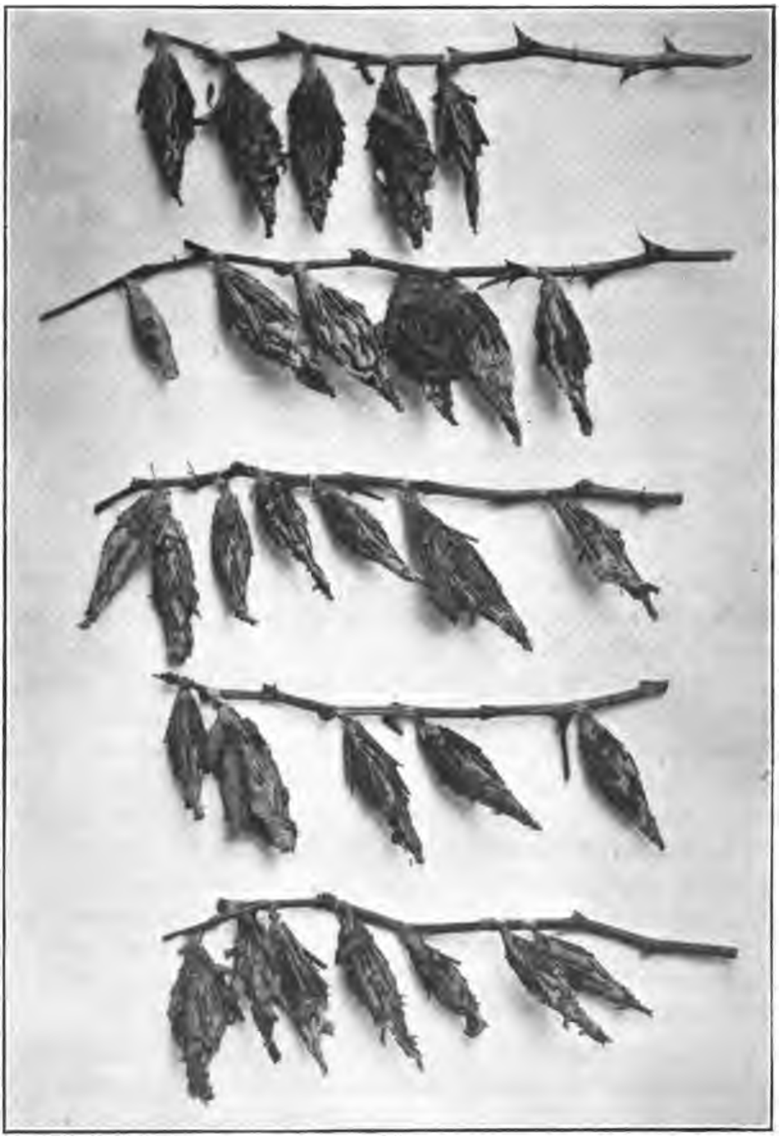


Plate 11. Shows the number of Bag Worm cocoons on some of the Black Locust twigs in a planting near Vernon.

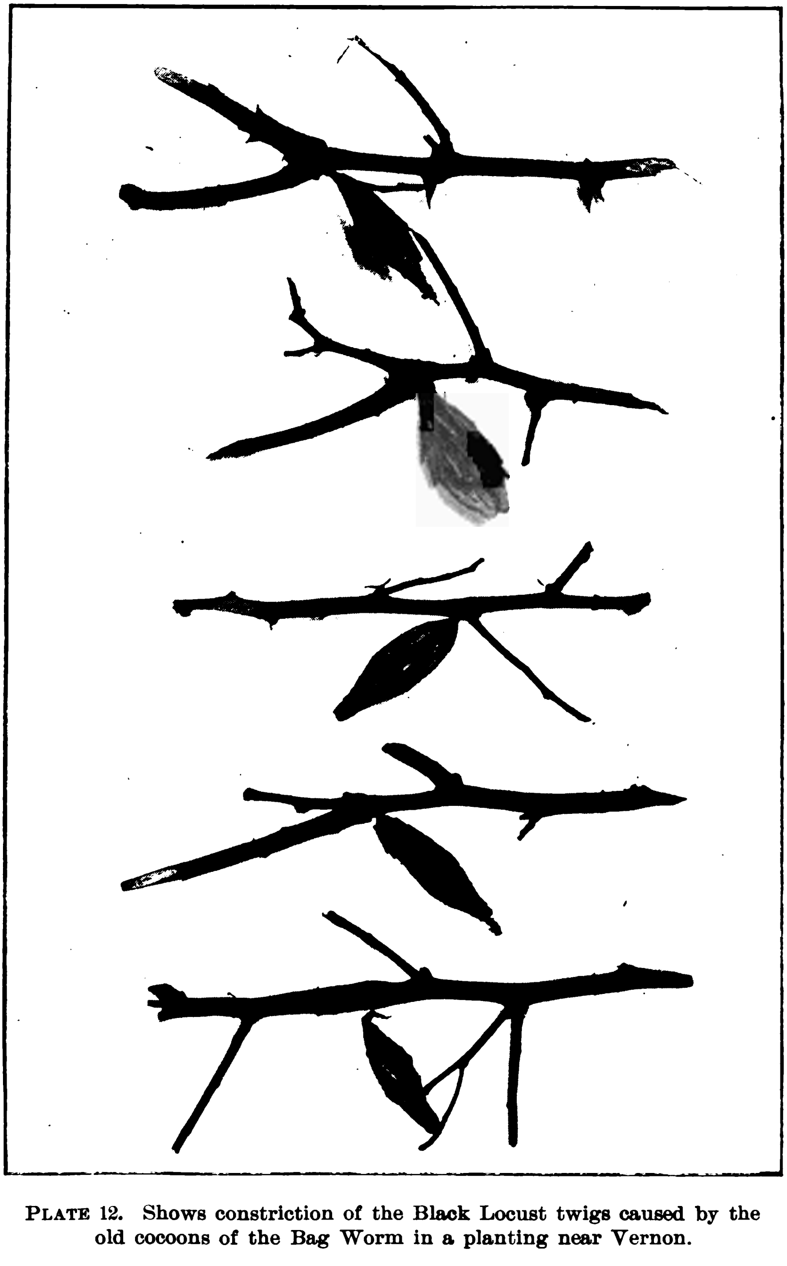


Plate 12. Shows constriction of the Black Locust twigs caused by the old cocoons of the Bag Worm in a planting near Vernon.

ing the hogs into the planting. A few young catalpa plantings were found which were ruined by being pastured with calves. The agent who sold the trees said that stock would not eat catalpa, but the owner found out too late that the agent's statement was not true.

Mistakes Made.—When a planting is old enough the owner invariably recognizes such mistakes as too close planting, lack of pruning and cultivation. Their experiences and suggestions agree with the recommendations set out in this report on the management of forest plantings.

Shade Trees.

BY CHAS. C. DEAM, SECRETARY.

The shade tree gets its name from the classification of trees on the basis of their use. Its destiny is not to be chopped up and transformed into something to gratify the physical man. Its mission is that of a living tree, not only to serve man with its welcome shade, but to educate and please his æsthetic sense. Its existence and care are an index of the development of this sense in its owner. When one admires a beautiful tree there comes a desire to know the congenial soul who welcomed its existence. If one seeks the noblest of men he will find them living, not along the treeless streets, but behind avenues of stately trees. When we speak of a beautiful home, the shade and ornamental trees are usually an important consideration. When we speak of a beautiful city, its parks, lawns and streets count for more than its architecture.

Contrary to the preceding statements, we find the shade trees neglected more than any other public improvement. The cost of planting and caring for shade trees is small when compared to their value to the grounds on which they stand and to the public in general. Yet in our most progressive cities we find lot after lot without a planted tree. It is a well-known fact that pedestrians favor the side of the street that numbers the most and larger shade trees. Real estate agents say nothing enhances the value of a residence property so much as possessing fine shade trees and being located on a street with a thrifty line of shade trees.

The planting of shade trees need not be limited to the streets of the cities, but could with equal benefit be extended to the main lines of travel in the country. It is a fact much to be regretted that so many of our country schoolhouses and churches are not surrounded by trees. To find a country school yard with a planted tree is the exception. We find substantial school buildings with surroundings as are shown in plate 13. This schoolhouse is one of three visited in the same district with no trees in the yard. These buildings are located in a community where farms are worth from $125.00 to $150.00 per acre. Yet the sentiment of planting trees is fostered in the public schools by biennial observations of Arbor

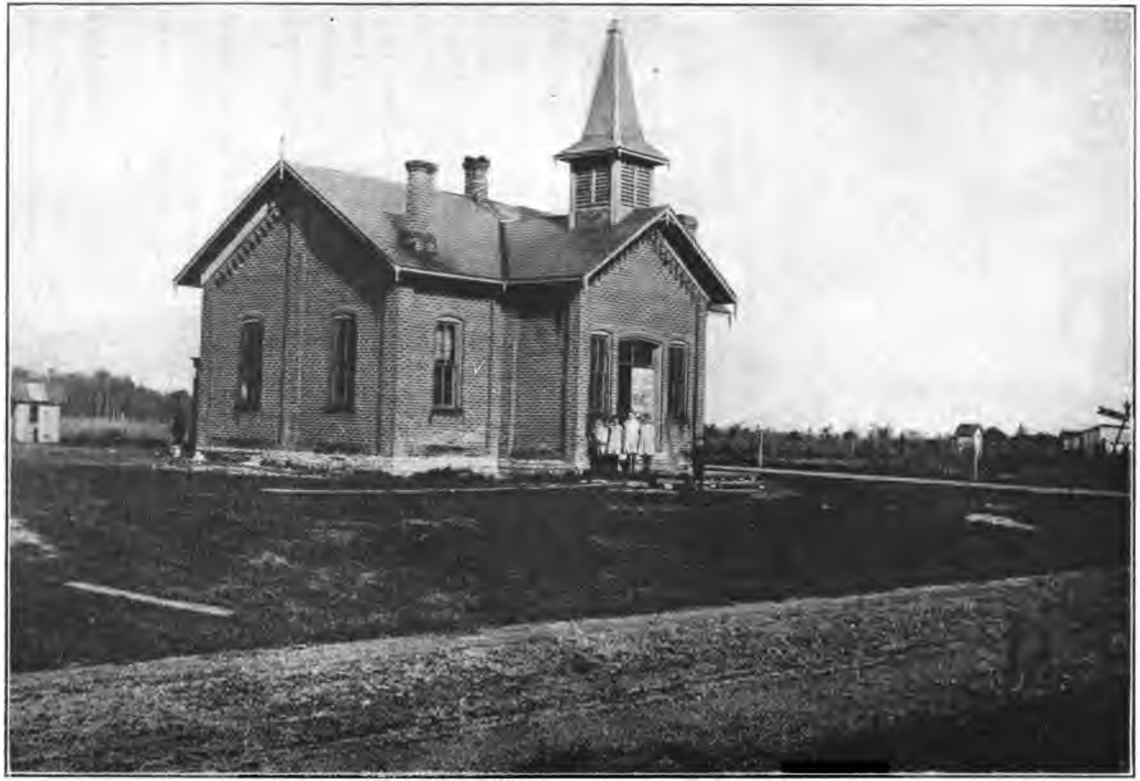


PLATE 13. Barren and treeless condition of many school yards.

Day. This is not sufficient. The children should be taught the importance of shade trees and how to care for them.

Since our native forest trees are disappearing there is an increased interest in planting ornamental and shade trees. It is the purpose of this article to briefly state some of the advantages of shade tree planting and give some instructions as to the selecting, planting and pruning of such trees, which will be followed by some of the Indiana laws governing shade trees.

USES OF SHADE TREES.

First.—Shade trees are planted primarily for protection from the sun. Along streets they are placed so as to shade both the walk and the driveway. In parks and lawns they are so spaced as to bring out landscape effects. The density and height of the shade can be governed by selecting suitable species and proper pruning.

Second.—The second in rank of the values of shade trees is that of ornament. The symmetry of the tree, the size, shape and color of the foliage must appeal to the sense of the beautiful, and have an ameliorating effect on harsher natures.

Third.—Are their protective value to man, animal and buildings from rain, snow, wind and storm.

Fourth.—Are their scientific and educational value. Forests are becoming so scarce and far removed that children who live in the cities learn much of the life history of trees from those that grow in the cities. This fact is a strong argument in favor of cities owning parks. The botanic interest and value of parks is underestimated. This assertion may be verified by questioning the city school teachers. In order to make the park of the most educational value it is suggested that as many species of the local trees, shrubs and vines as possible be planted. Those of foreign origin should be selected with the idea of showing different foliage, flowers, fruits, etc. It is variety, not uniformity, that pleases.

Then, too, the trees in the city attract a great number of birds, which enables the children to learn many species and to study them at close range.

Fifth.—Shade trees have a hygienic and sanitary value. They absorb obnoxious gases and throw off oxygen. Their roots deeply penetrate the earth, which furnishes better drainage conditions.

Sixth.—They increase the value of the property on which they are planted, and in a measure that of adjoining property. There are court decisions which show that single trees have been valued at hundreds of dollars.

SELECT A TREE THAT IS ADAPTED.

First.—To the space available for planting. Frequently there is little choice in the area that can be given to a street shade tree. The line of trees may already be fixed and all that can be done is to fall into line. However, there are many streets yet unimproved along which it has not been decided where the walk and shade trees shall be placed. In this case it is suggested that the walk be built next to the curb and that the trees be planted in the lawn, about eight feet from the walk. The reasons for so doing are as follows:

(1) The tree in this position can not be used as a hitching post or be injured by vehicles.

(2) The root system is cut off in one direction only, which makes more favorable conditions for the long life of the tree than if the feeding roots should meet barriers in two or more directions.

(3) The top or crown is farther removed from the string of wires which are usually along the curb line.

(4) The trees being in the lawn the owner has a better opportunity to enjoy their shade by being able to place his chair, or hammock, under them. Then, too, the trees will usually be close enough to the house to protect it from the sun.

(5) When the walk is along the curb expectorations will be cast into the gutter, which is a sanitary argument in favor of making the walk next to the street.

The objections to locating the walk next to the curb line may be stated as follows:

(1) Pedestrians are in more danger from passing vehicles and possibly from a falling live wire.

(2) The trees shade the house to such an extent as to cause it to decay. It is evident that if a roomy lawn is desired on a lot of one hundred forty feet depth, one can not house a horse, cow and chickens and have a good sized garden. In order to have this miniature farm the house is built so near the street that there is no room for a lawn. It is this class of property owners who find the shade trees too close to their dwellings. It is surprising how many peo-

ple will sacrifice the arcihtecture of their buildings and deny themselves of the ornamental value of flowers and shrubs for an extra onion bed in the rear of their lot, or for the privilege of maintaining a neighborhood nuisance in the form of keeping some chickens.

If the root space in which a tree is to grow is limited, trees that do not grow large or those that grow a tap root system should be selected.

If the space in which the crown is to develop is limited in width a tree that grows tall and narrow should be selected, such as Lombardy or Carolina poplar, magnolia, sycamore, ash, yellow poplar, etc.

If the tree is to meet obstacles from above, a low crown tree, such as horse chestnut, mountain ash, ailanthus, Norway maple, osage orange, etc., should be selected.

If the tree has plenty of both root and crown space the white elm and hardy maple are the most desirable trees to plant. The elm on the moist and the maple on the drier soil.

Second.—Select a kind of tree that is adapted to the soil in which it is to be planted. Trees have hereditary characters which should not be ignored when selecting the kind of a tree to plant. Some trees, such as sycamore and elm, do the best in moist soil, while beech and white oak do not. Unless a tree is selected that is adapted to the soil conditions of moisture, water level, porosity, drainage, depth and quality, it will not thrive and bring out the characteristics of the tree, which result naturally from a well-nourished condition. If the tree is ill adapted, it may be expected that the tree will leaf out late, drop leaves during the season, shed its foliage early, and that the foliage will not have its characteristic color, either in the summer or autumn. Its limbs will not have their characteristic position, the tree will be short lived and have a sepulchral aspect, which detracts from its ornamental value.

Third.—Select a tree that is adapted to your climate. This means a tree that will not be killed by freezing or injured by early or late frosts. One that is adapted to the humidity of your atmosphere and one that will thrive with the annual amount of rainfall of your locality.

Fourth.—If the tree is to be planted where there is an excessive amount of smoke or chemical gases, one should be selected that will endure them to the greatest degree. In this case plant ailanthus, osage orange or catalpa.

Fifth.—Freedom from disease and insects is a very important thing to consider in making the selection. The facts are that the best kind of shade trees have enemies, and if it is desired to plant them the objection will have to be waived and depend on fighting the enemy. In this State, as yet, the only trees that have deadly enemies are the elms, maples and linden. The San Jose, cottany maple and oyster scale have killed a few trees of other species, but the damage as yet from this source is not serious.

Sixth.—Some trees may be objectionable because they self-prune to such an extent that they constantly produce a litter on the ground. The sycamore is frequently condemned because of the litter made by the exfoliations of the bark and by the fruiting balls that fall during the winter. The silver leaf poplar is objected to because of the numerous root sprouts which must be contended with. The fruit of some trees attract birds, which is an objection, and the odor of the staminate flowers of the ailanthus is offensive to some.

Seventh.—A rapidly growing tree is usually desired, but this important feature is not always found in the tree that is preferred. This encourages the owner to plant large trees, which is to be discouraged, not only on account of the expense, but because a high percentage of large trees die. Then, too, they are usually so severely top-pruned when planted that decay immediately sets in. For the best results a tree not over ten feet high should be planted, and a tree half the above height will be surer to grow and give a better opportunity to train the crown.

DISCUSSION OF SOME OF THE AVAILABLE SPECIES.

Based upon the considerations outlined in the preceding paragraphs, the advantages and disadvantages of the principal trees used in Indiana for shade tree purposes will now be discussed.

(1) *The White Elm.* The white elm is a very hardy and long lived tree; easily propagated, rapidly growing and of clean habit; adapted to wet, moist and fairly dry soils; grows tall, stately and graceful, very variable in form, usually with a vase shaped crown; leaves appear early in the spring and remain until late in the fall; for its best development it should be spaced from thirty to forty feet.

The elm and maple easily head the list for Indiana shade trees. Like its rival the maple, it has more enemies than the less desirable species. The elm leaf beetle, elm borer, and cottony maple scale are its worst enemies, frequently proving fatal to it. This fact deters many elm loving people from planting it.

(2) *The Hard Maple.* It is very hardy and long lived; transplants with some difficulty; adapted to a moderately dry soil; medium in size, oval in outline, of fine proportion, upright and of clean habit; of medium height when grown in the open, with numerous branches; leaves appear early in the spring, produce a dense shade, and fall late in the autumn; the foliage, with a purple tinge in spring, pleasing shade of green in the summer, and with gorgeous tints of orange, yellow, red and brown in the autumn, makes it the most beautiful of all our native trees; endures shade, but like other kinds of shade trees it should not be allowed to touch its neighbor; at maturity it needs from thirty to forty feet of space. It is a slow growing tree, and for that reason it is suggested that if quick shade is desired, the trees be planted thirty to forty feet apart and temporary trees which are fast growing be planted in between them. When it is observed that the temporary tree is touching the maple or by shading it is modifying the outline, it should be removed. The preceding suggestion is made with some reserve because of the disposition to neglect the thinning. The most destructive enemies of the maple are the maple borer, tussock moth and cottony maple scale, which sometimes kill the tree. These enemies are very injurious to the soft maples, but the hard and Norway maples are generally immune.

(3) *Norway Maple.* What has been said of the hard maple may for the greater part be said of the Norway maple. It is a much smaller tree and has a tendency to head low. Usually the tree is permitted to head too low, and frequently an attempt is made to correct this error, which results not only in destroying the symmetry, but leaves vulnerable points for decay. The Norway is rapidly coming into favor, and where a tree smaller than the hard maple can be used it is the best substitute.

(4) *Soft Maples.* These are the red and white maples, well adapted to wet and moist soils, yet both will thrive in drier situations; easily transplanted; medium sized trees, have a tendency to grow long and slender branches, which are easily broken off by the wind and ice, and which are always a temptation to the tree butcher to get a job of cutting them back; the crown of each is similar in shape to the hard maple, though not so compact nor

symmetrical; the shape, color and duration of their foliage are surpassed by no other tree. The beauty of the tree, together with their rapid growth and low cost of seedlings have caused them to be planted more than any other tree. However, in several parts of the State these trees are being killed by the maple borer, cottony maple scale, and the defoliation by the tussock moth is endangering them.

(5) *The White and Green Ash.* Are very hardy, rapidly growing, medium sized trees; adapted to a moist or dry soil, though their preference is for a moderately moist and well drained soil; easily transplanted and require about thirty feet of space; lower branches short and horizontal, but the main branches ascending, and the general aspect of the trees is that of a tall and narrow one; foliage attractive, but appears late in the spring and falls early in the autumn. The fact that they are clean in habit, and that they are not seriously affected either by insects or fungi recommend them for street planting.

(6) *The Sycamore.* Is hardy, grows large and tall, and at maturity should have thirty to forty feet of space; transplants with best of success; adapted to a moist soil, though it does well in drier situations; grows rapidly with the main branches ascending, elliptic in outline; has an attractive foliage, with long leaf period; trunk and branches have a picturesque mottled gray color due to the flaking off of the bark; is practically free from insects and fungous diseases. The litter caused by the bark flaking off and the fruit falling in the winter are the objections to this tree. It is used more frequently in the southern part of the State as a shade tree, and with good success. Bears pruning well and recovers rapidly.

(7) *Linden or Basswood.* Is hardy, grows rapidly; medium sized tree, with ovate crown; transplants well, but the body sun scalds and should be protected at least for two years; adapted to a rich, moist soil; attractive large green leaves, which are a few weeks shorter in leaf period than the maple; the numerous large, creamy white flowers afford excellent food for the honey bee, but the litter made when they fall, together with the seed when they fall, are the objections to this tree. The cottony maple scale is destructive to this tree and in several localities of the State they are killed by it.

(8) *Carolina and Lombardy Poplars.* Are hardy, grow rapidly; usually die before they are twenty-five years old; adapted to a moist soil, though they thrive in drier situations; grow very tall and narrow; short leaf period; are objected to on account of the leaves falling during the season and the litter made in the winter by the falling of the small branches.

Many cities have passed laws compelling the owners to kill all trees of these species because their roots in search for water stop up sewers. These trees are seldom used any more for street trees and should be planted only as temporary trees.

(9) *Cottonwood* (*Populus deltoides*). Is hardy, grows to a large size; transplants successfully; adapted to a moist soil, and requires at least forty feet of space; grows very rapidly, with large, ascending branches, develops a wide open and graceful crown; bears pruning well; its worst enemy is the scale. Since there are so many trees that are as good as and even better than this, it is not recommended for street planting. However, it is quite frequently used.

(10) *Silver Leaf Poplar.* Is very hardy, and transplants well; prefers a moist soil, but appears to thrive on any kind of soil; grows very rapidly, with large ascending branches; is a large tree and requires about fifty feet of space at maturity; develops a very wide arching crown; leaf period long; foliage attractive in appearance and beautiful in color; has no serious insect or fungous enemies. It sends up numerous root sprouts, which is the objection to this tree. It is especially recommended where single individuals can be planted in country church and school yards. It is also the best tree for the farmer to plant in his barnyard, because it develops the largest crown and will endure more "tramping" than any other tree.

(11) *Tulip or Yellow Poplar.* Is hardy, transplants well; prefers a moist, rich soil; large and stately, rapidly growing; develops a narrow pyramidal crown; its straight trunk and strict habit recommend it; leaf period a few weeks shorter than the maple; leaves large, four lobed, bright green and lustrous, turning yellow in autumn; flowers large cup shaped, very ornamental; the tree in fruit appears a massive candelabrum. This tree is coming into favor more each year, and is especially recommended along streets where it can have room in which to develop. At maturity it should have at least thirty feet of space. It has no serious enemy.

(12) *Hackberry.* Is hardy, transplants well; adapted to a wet or moist soil; a large, tall, long lived tree; crown conical in outline, often with pendulous branches; bears severe pruning and recovers rapidly; has but one enemy of any consequence and that is the hackberry gall, which detracts from its winter appearance. If for any reason the elm could not be planted the hackberry would nearest take its place in appearance and soil adaptation.

(13) *Catalpa* (*speciosa*). Is comparatively hardy, easily transplanted, adapted to a moist loam soil; grows very rapidly for the first few years, main branches ascending with short horizontal ones; crown narrow oblong; shade dense, with short leaf period; admired for the large panicles of flowers and large green leaves; is tolerant of coal smoke to a great degree; the ripened pods of a foot or more in length which fall in winter make a litter which is the principal objection to this tree. The larva of the catalpa sphinx, which defoliates it, is the only insect enemy.

(14) *Catalpa* (*bignonioides*). What has been said of the other species of catalpa may be said of this species, except that it is a low growing tree and has a wider, branching crown. It does not grow a trunk long enough to make a suitable street tree. It is falling in the estimation of the public, and in one of the largest cities of the State it is being removed from the parks on account of the profuse litter it makes.

(15) *Horse Chestnut.* Is medium in size, has a large oval crown, which produces a dense shade; has large panicles of ornamental flowers; glossy winter buds relieve the lifeless appearance of the tree in winter; bears pruning well and recuperates quickly; has no enemy sufficient to deter one from planting this tree, if a small or medium sized tree is desired.

(16) *Box Elder.* Is hardy, adapted to moist soils; medium sized; short lived; grows rapidly with an oval crown; pale green color of twigs make it attractive in the winter condition; leaf period not long; foliage frequently attacked by a fungus, which gives it a sickly appearance. This tree has been frequently planted with almost universal disappointment.

(17) *Magnolia* (*acuminata*). It is little known in Indiana. The general natural distribution of this tree extends into Ontario, but in Indiana it is found only in the southern part of the State. The few trees observed appear to be hardy and thrifty. In appearance it resembles the yellow poplar, with more numerous short

horizontal branches. In outline the crown is long and narrow. It is adapted to a rich, moist soil, and farther south grows to be a large and tall tree. It is believed this tree is worthy a trial where a tall and narrow crown is desired. It is not subject to destructive insects or fungi.

(18) *Sweet Gum, or Liquidamber.* The natural distribution of this tree is in the southern part of the State. It is hardy wherever found, and it is believed it could be grown in all parts of the State, if planted in moist soil. It is hard to transplant, and for this reason small trees should be used. The natural habit of the tree is to grow tall and narrow, but in many instances when grown in the open it assumes the outline of the hard maple, from which at a distance it is difficult to distinguish on account of the similarity of the shape of the leaf and outline of the tree. It grows rapidly and if the terminal is lopped it will assume a rounded shape head. The glossy green color of the foliage, with its changing autumnal tints, makes it one of the most ornamental of trees. It is practically free from enemies. The litter made by the balls falling during the winter months is the only objection to this tree.

(19) *Pin Oak* (*Quercus palustris*). Is the most desirable oak to plant. Is adapted to a very moist soil; grows rapidly; medium to a large size tree. The oaks have a tap root, and for this reason small trees, or, better, the germinated nuts should be planted. The branches are numerous, the lower pendant, the upper horizontal or slightly ascending, forming a crown oval in outline; the leaves are a bright green, deeply lobed, producing a dense shade, in autumn passing through many tints of red, which commend this tree. It has no destructive insect, but is frequently attacked by an oak gall insect, which detracts from its winter appearance.

(20) *Red Oak* (*Quercus rubra*). What has been said of the pin oak may be said of the red oak, except that it is a larger tree, with ascending branches and less lobed leaves.

(21) *Osage Orange.* This tree is not frequently used, but if an excess of smoke is to be encountered it is one of the very best trees to plant. It is easily transplanted, adapted to any kind of soil; may be pruned to any shape; very persistent; a low tree with a wide spreading crown, bright green leaves and large lemon-colored fruit. The scale insect is its only destructive enemy.

(22) *Black Locust.* It is easily transplanted, adapted to a dry clay soil, but will thrive in moister and richer soils; rapid grower;

medium sized tree, elliptic in outline; main branches ascending, to which are attached many straggling branchlets; open crown; will not endure shade, which causes a litter by the small dead twigs falling during the winter; has large racemes of white flowers, which in a measure compensate for the many objections to this tree. In the northern part of the State the locust borer is very destructive. The objections to it are that it sprouts freely from both the roots and seeds.

(23) *Honey Locust.* Is hardy, transplants well, adapted to damp soils; rapid grower; very variable in branch habit, but usually develops a crown similar to the elm; will not endure shade, which causes it to throw down in winter many dead twigs, which, with the long, dead pods that fall during the winter months, make an objectionable litter; crown open, produces only a moderate shade; would not be considered were it not that it is frequently planted. It has no destructive insects.

(24) *White or Golden Bark Willow.* It is hardy, transplants easily, grows rapidly, adapted to a moist soil; may be pruned to a desirable shape; develops a broad and oval crown; the tree is attractive during the entire year, the catkins in spring, the foliage in summer, and the glossy yellow and graceful branches in winter; produces a dense shade; is especially adapted for a "setting" in a lawn or park. In summer the slender branches gently waving in the air suggest rest and comfort. It has no destructive enemies.

(25) *Ailanthus.* Very hardy and grows rapidly; has the ability to endure the smoke and gases of cities to a greater degree than any other species of deciduous trees. Adapts itself to all kinds and conditions of soil; medium in height, develops a terminal leader and usually each year grows a whorl of branches which afford an excellent opportunity of pruning to a desired shape; stands pruning well and heals rapidly; crown usually broadly oval; leaves compound, very large, deep green and have a tropical appearance; leaf period long; in autumn the large clusters of brilliantly colored fruit add attractiveness to the pistillate trees; the male trees are more compact and symmetrical in outline, but the odor of their flowers is objectionable to some. No tree will stand more neglect or abuse than this tree. It is free from all insect and fungous enemies.

(26) *Oriental Plane.* It is similar to the native sycamore in foliage, habit, form, etc. It is to be preferred to the native sycamore,

because it is free from fungous diseases. It is one of the best street trees known.

(27) *Birch.* The birches are little used as street trees. They are very ornamental and are especially recommended for locations in parks and lawns. They grow rapidly, with graceful habit. Their picturesque trunks with their slender and often pendulous branches form a striking contrast to most other species.

(28) *Mountain Ash.* This is one of the best ornamental trees to plant. It is a small tree, develops a crown globular in outline, has attractive clusters of white or pinkish flowers, and a pleasing foliage. The clusters of red berries, after the leaves fall, make it an object of admiration and afford a luncheon for the birds on their way to their winter homes. It has no destructive enemies, and is recommended as an ornamental tree for lawns and narrow streets.

(29) *Varnish Tree* (*Koelreuteria*). It is a medium height tree with a round head; adapted to moist, rich soil; long leaf period; has large panicles of showy yellow flowers, which are soon followed by large triangular inflated pods; the large compound leaves produce a dense shade; leaves purplish green when young, gradually becoming a bright lustrous green, and in autumn fading with exquisite tones of yellow, crimson and brown. It is difficult to get it to develop a straight trunk to a suitable height. This tree has been planted only locally. At New Harmony it has been used very successfully for many years, and is locally known as ''gate tree.'' See Plate 14.

(30) *Paulownia.* This tree is hardy in the counties bordering the Ohio river. It is a medium sized tree, similar in appearance to the catalpa; has large erect panicles of blue or violet flowers on the ends of the branches; free from insects. This tree has been recommended for planting in this State, but it is believed it will not be hardy far north of the Ohio river.

There are other trees, such as the beech, oaks, hickories, walnuts, etc., which have people who champion their planting, but it will be found upon investigation that they have some objectionable features. They may be subject to destructive insects, slow growers, very difficult to transplant, short leaf period, or continually making a litter. The evergreen (conifers) have not been mentioned, because they are seldom planted for shade purposes.

PLATE 14. Koelreuteria as a shade tree along a street in New Harmony.

PLANTING.

There are diverse opinions as to the best time to plant, as to the depth and width of the hole, mulching, etc. It is not presumed to be dogmatic, but only one way is here given, which appears to be the most scientific and generally accepted method. It is not contended that there are not other methods equally as good.

Time to Plant.—If a definite time for planting can be selected, it is best to plant trees that have a surface root system, such as elm, ash, sycamore, etc., just before they leaf out. If the tree to be planted has a tap root system like the walnut, hickory, oak, etc., it is better to plant them several weeks before they leaf out. Spring appears to be the favorite and most successful time to plant.

Care of Trees Before Planting.—If the trees are to be taken from a nearby woods, care should be taken to get as much of the root system as possible. The roots should not be permitted to become dry and should be covered with something, such as wet straw or burlap. It must always be borne in mind that the wind will dry the roots as well as the sun. It is a common practice for men who plant shade trees to go to the woods, dig a load of trees one day and plant them the next day without in any manner protecting the roots from the wind and sun. The reason so many planted trees fail to survive is because they are as good as dead when they are planted.

If the trees are received from a nursery it must be remembered that the tres may have been in transit many days, much of which time they may have been exposed to the wind and sun. They usually arrive in about the same condition as a car load of live stock "suffering for a drink." If the trees are to be planted in a few days, they may be stored in a damp cellar. If the trees appear to be dried out, it is wise to dampen the burlap in which they are packed. If it is found that the trees can not be planted at once, they should be heeled in. This does not mean to pile some earth on the bundle of trees as received from the nursery, but that the bundle be opened and the trees placed closely in a trench, located, if possible, on a north slope. Dig the trench parallel to the slope, to give better drainage, and cover the trees with earth to a depth of twelve to sixteen inches. The tops should be protected from the wind and sun by some kind of shelter. Some loose boards laid on a hitchrack shape support will answer very well. Never cover the tops with straw or corn fodder if the trees are to remain in the ground a considerable time, or during the winter, because mice or rats will find the place a comfortable home and bark your trees.

Work of Planting.—Do not be careless in the work of planting. When you plant a tree go at it with a determination to succeed, and to succeed you must have a good live tree and then meet the conditions of transplanting. There is more carelessness exhibited in tree planting than ignorance. Do not take a gambling chance. As is frequently the case, the work is entrusted to some one who is not only ignorant of the requirements of tree planting, but who has no interest in the success of the planting.

It is best to defer planting until the ground is dry. If the tree is mudded in, enough of the feeding roots or root hairs will not be in contact with the soil when the soil dries out, and as a consequence the tree dies. It is seldom the ground becomes too dry in the spring.

The hole in which the tree is to be planted may be dug in advance of the time of planting, but if the work can be done at the time of planting it is as well. Then the earth is in a better condition for filling and the temptation to fill with a shovel of compact earth is avoided. The size of the hole should vary with the size of the root system and character of the soil. If the ground is a rich, loose loam, with good drainage, it is not necessary to make a hole much larger than the roots themselves. If the soil is very compact a hole some deeper and much larger should be made. The usual size is about twenty inches deep and fifty inches in diameter. In digging the hole the top and loose dirt should be placed in a pile by itself, and it, or other top dirt, rich in humus, be used first in planting. If it can be had, the greater part of the hole should be filled with loose, rich soil. Do not mix stable manure with the dirt in planting, nor put any in the bottom of the hole. The practice of putting brickbats, bones and old shoes in the hole is not necessary; their immediate effects are to conserve the moisture and aerate the soil.

The first thing in planting is to cut off all the broken roots. Remember to keep the roots moist while planting; if several trees are taken to the planting ground at once, keep a cover over the roots. Secondly, place the tree in line with the main branches to the west or southwest. It is best for some one to hold the tree and give directions for the filling in. The roots should all be straightened out, and in no case curve them because the hole is not quite large enough to straighten them out. Make the hole larger. After the roots are placed in their natural position, begin by sprinkling loose soil upon them, being careful to do the work slowly enough to work in the soil closely in about the roots. The work should be continued until all the roots are covered, when the surface may be slightly firmed with the foot. Then completely fill the hole, making ample allowance for the settling of the ground about the tree. After the hole is filled, do not tramp the ground. Leave the surface soil loose. It is advised to use a surface mulch, such as old straw, coarse gravel, or old coal cinders, from which all soluble salts have been washed. During the summer grass cut from the lawn may be used. The objection to gravel or coal cinders is that they get scattered and into the knives of the lawn mower.

No mention has been made of the use of water in planting. There is no objection to the use of water when needed, if properly used. It may be used in a loose or loam soil, but not in a compact soil.

Before Leaving the Tree.—Before leaving the tree the crown should be pruned so as to balance the root system, but not "topped." The amount of pruning to be done will depend upon the species planted and the size of the root system when compared with the size of the crown. This means that, usually, large sized trees must be severely pruned to secure a balance. Generally nursery stock has many more fibrous roots than trees that come from the forest. It will be found that the smaller the tree the larger will be the root system in comparison to the top, which is a strong argument in favor of the use of the small tree.

Trees that have a surface root system with many fibrous roots, such as the maple, will not require so severe pruning as those that have a tap root system or have only a few surface roots. The pruning should be confined to cutting off the lower branches and cutting back the laterals, and if possible to spare the terminal. In doing this work it should be borne in mind that in a few years the lower limbs should be removed. A fork should never be left, though for a time its removal may disfigure the tree. A young tree will soon correct its shape, but on a large tree it is difficult to dispose of a fork without mutilating the tree.

Make a Guard Around the Tree.—Small trees should be protected for several years by being enclosed in such a manner that vehicles and animals can not reach them. A small tree is a constant temptation for every passing boy to swing on it, which eventually kills it. The tree should be enclosed to a height of five or six feet. This may be done with lumber, wire netting, or if a more ornamental guard is desired, a wrought iron guard may be purchased. It is also wise to protect the south side of the tree from the sun, in order to prevent sun scald. This may be done by using one or more boards on the south side of the guard.

Care After Planting.—If after the tree has been planted for some time it does not rain, it is wise to water it. Do not drown or drench it. Dashing water around a tree compacts the soil, which should always be kept loose to a depth of a few inches. If a straw or cinder mulch is used the above precaution is not necessary.

PRUNING.

There is a difference of opinion as to the best time of the year to prune shade trees. The favorite time appears to be in the spring of the year. The best authorities say it is not so much the time of the year as the manner in which the work is done. However, small branchlets may be removed any time of the year, for wounds on them will heal quickly. Larger live branches should be taken off any time after all the leaves have fallen until early spring.

Pruning may be divided into dead and green pruning.

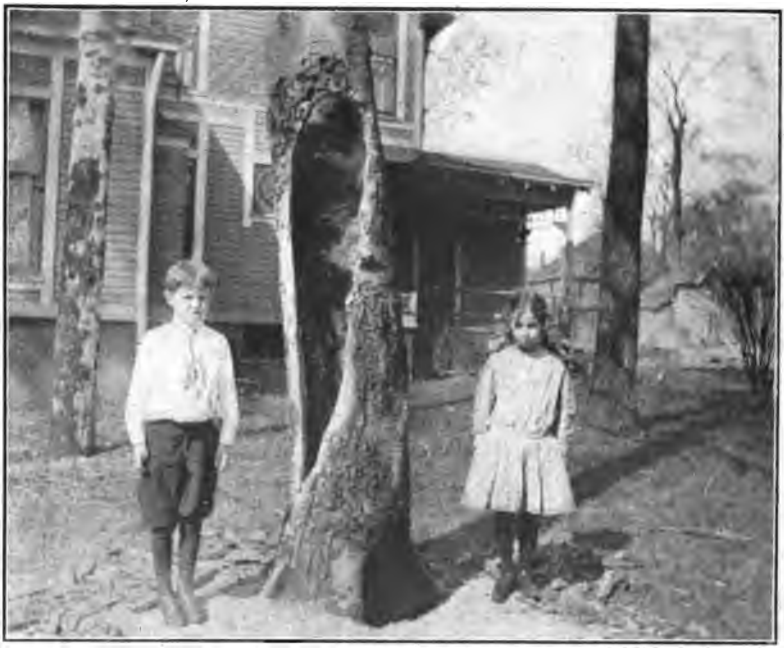


PLATE 15. Shows work of the tree surgeon in Indianapolis.

Dead Pruning—Is the removal of dead or diseased branches, and of decay from branches and trunk. This work has developed a branch of pruning known as tree surgery. Tree surgery may be done any time of the year, though early spring is to be preferred. Plates 15, 16 and 17 illustrate the work of the tree surgeon. The tree surgeon is busy trying to correct the error of the so-called tree pruner and to prolong the life of trees dear to the owner.

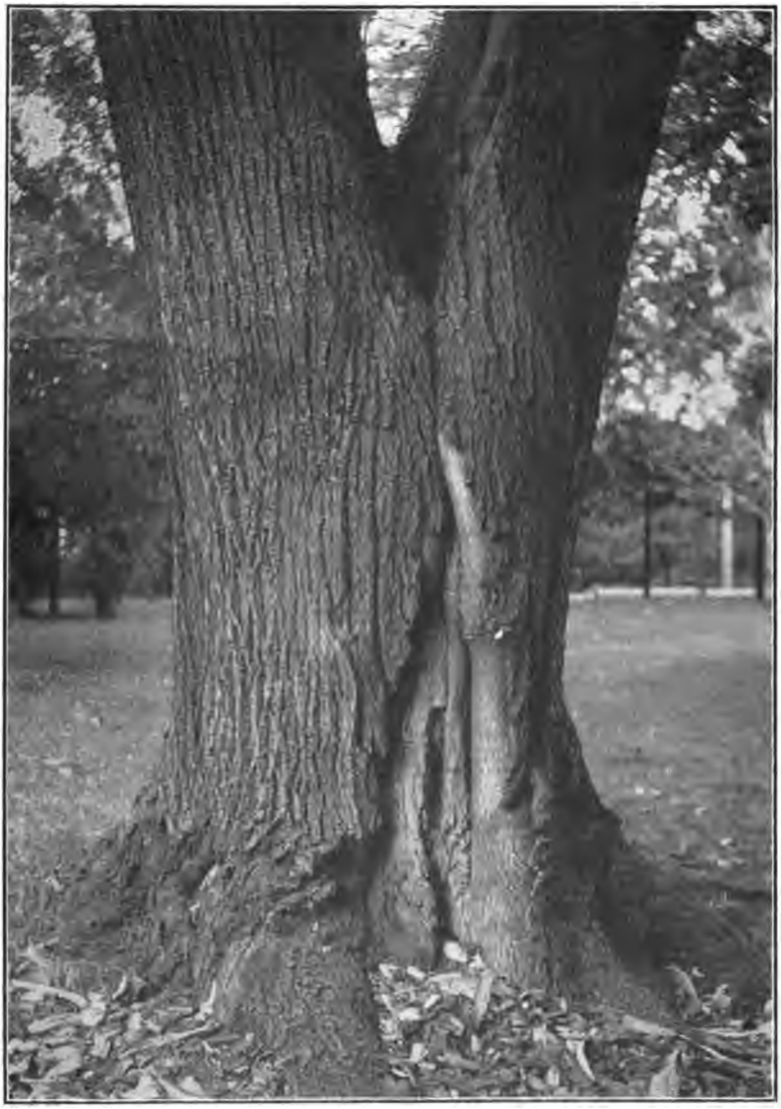


PLATE 16. Shows the decay on the trunk of a large tree.

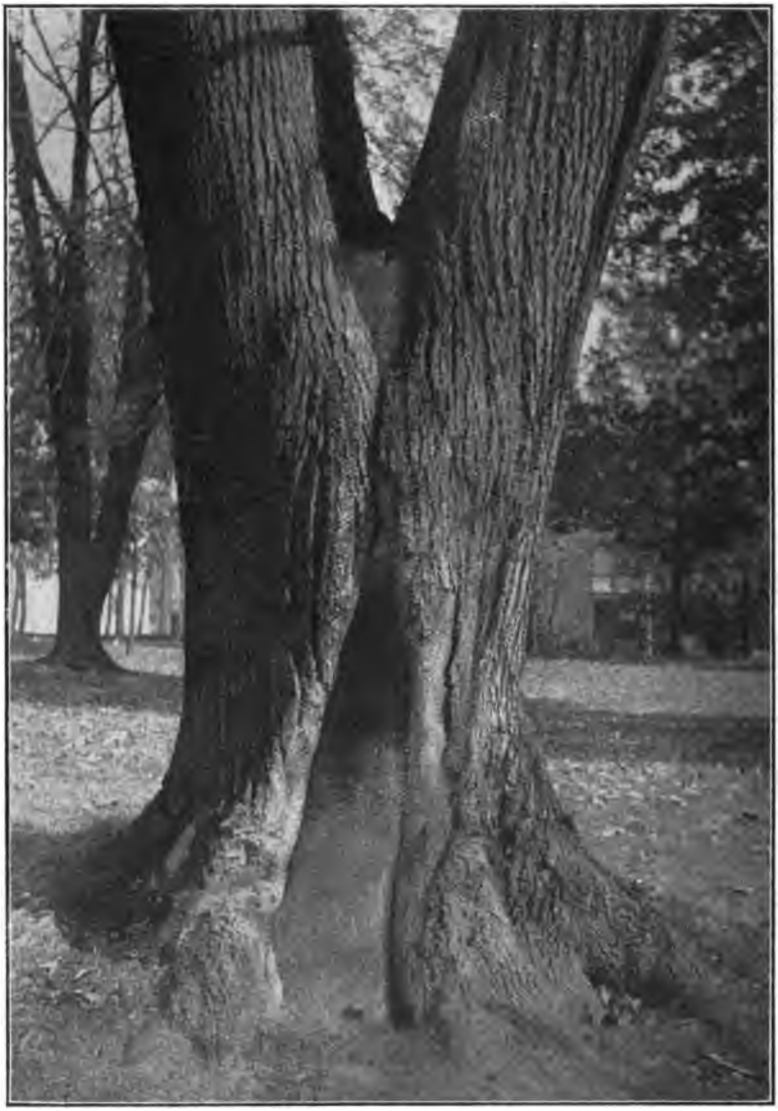


Plate 17. Shows the same tree after the tree surgeon had completed his work.

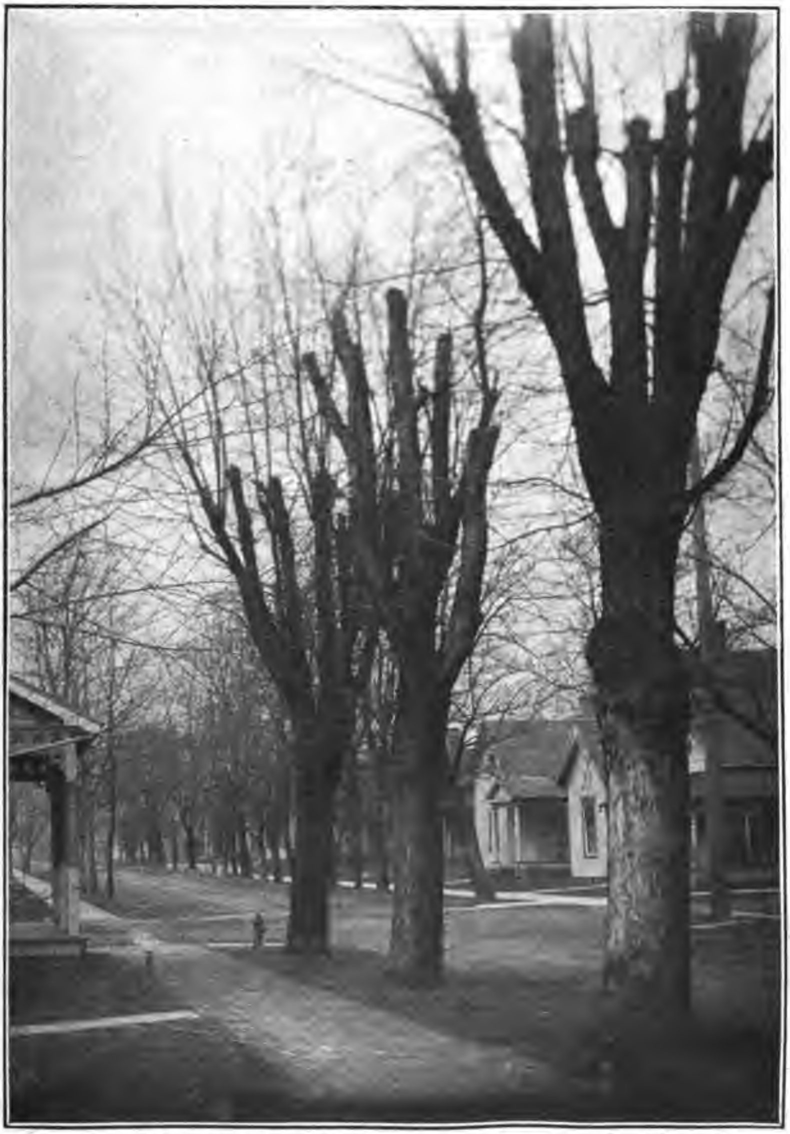


PLATE 18. Characteristic method of pruning large maples, which brings early death to the tree.

It is hoped that all cities will pass ordinances that will prohibit any one but a graduate of a school of forestry, or one who has had ample experience under a professional tree pruner, to prune shade trees. The planting, spraying and pruning of shade trees should be done by the city, and not be given over to the caprice of the several lot owners. So long as any one not too decrepit to handle a saw is permitted to attempt to prune shade trees, so long may we expect work for an army of tree surgeons, and have a crippled lot of shade trees. It is believed there is not one in a hundred of the maple trees a foot in diameter that is a perfect tree. See plate 18. The ignorant tree butcher has already injured them to such a degree that they are ready for the tree surgeon, and in many cases the state of decay is so far advanced that the tree is worthless. A casual survey of conditions would incline one to think that a majority of the people prefer a crippled tree to a healthy and vigorous one.

The most despicable form of pruning is to cut off the top of large or medium-sized trees. The alleged reason for so doing is that the trees are growing too tall. The reason so many trees grow tall is because they do not have room to develop otherwise. In such cases you will find the trees planted from ten to fifteen feet apart and that no attempt has been made to thin them. It is not so important how close you plant your trees as how close you permit them to remain in the row. As said before, shade trees should never be permitted to touch their neighbors, and should be thinned before this time. Some species require several feet of space between them and their nearest neighbor for thir normal development. The thinning process should be contemplated when the trees are planted, and they should be spaced accordingly.

Another source of tree mutilation is the attempt to correct the error of allowing the tree to head too low. When the tree is young the lower branches do not interfere with the pedestrian or obscure the view from the street. When the tree has grown to a diameter of a foot or more it is found that the lower limbs are too low and that they must be removed, which in a majority of cases not only destroys the symmetry of the tree, but makes such large wounds that decay is liable to develop.

Along residence streets, where large or medium-sized trees are planted, it is advised to start the head of the tree at least ten feet high, for the following reasons:

(1) This height affords an unobstructed view of the street from the first story of the house.

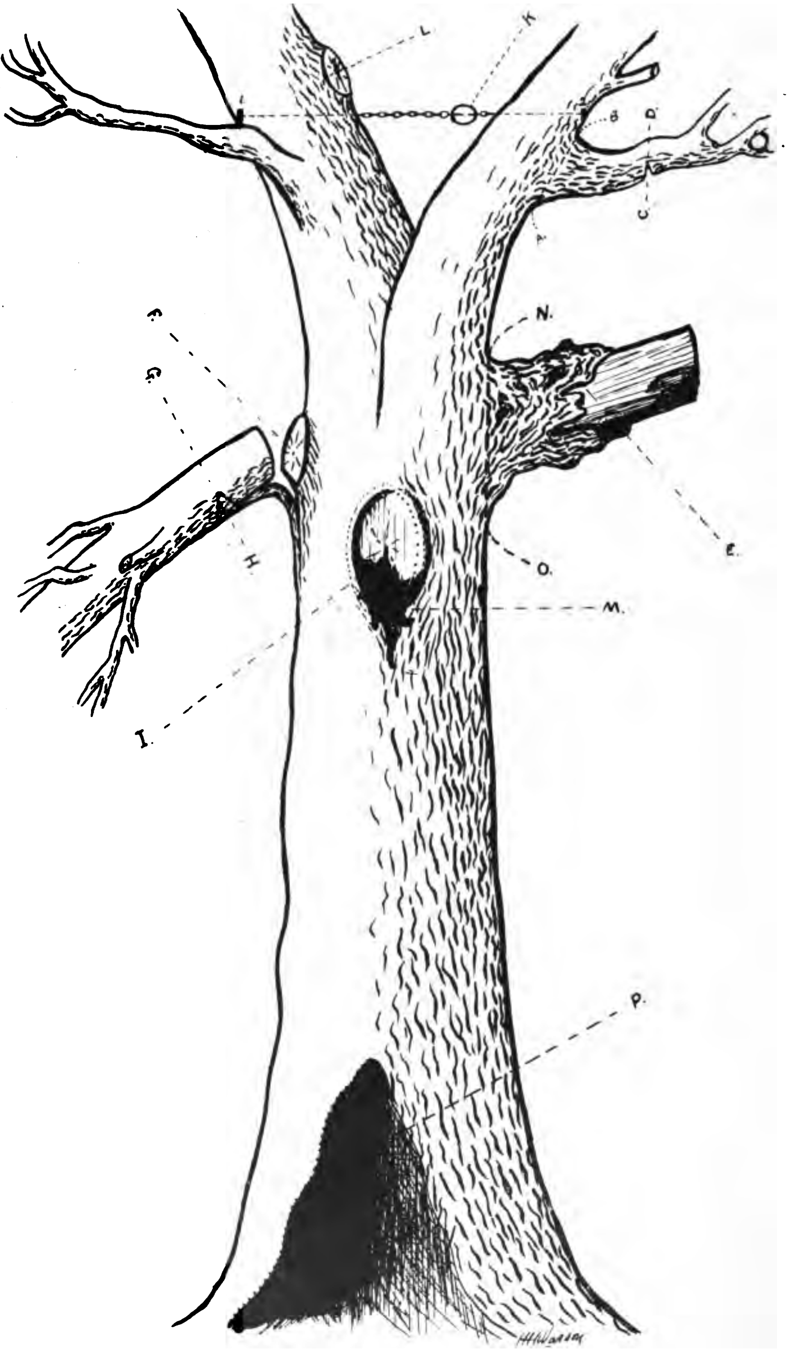
(2) It admits more sunlight to the first story of the house.

(3) Permits and encourages the free circulation of air under the trees.

(4) The shade is not so dense under the trees as to prevent the grass from growing under them.

(5) Does not interfere with pedestrians who carry umbrellas in rainy weather.

Green Pruning.—The amount of green pruning depends upon the species, tastes of the owner and the environment of the tree. The tree planted in a lawn should receive different treatment from the one planted along the street. As a rule street trees are pruned for form only. The form of the crown will in a great degree depend upon the habit of the tree and the space in which it has to develop. Frequently young trees will develop irregularities of outline. It is at this time that a skilled tree pruner is needed. Delay in pruning means larger wounds, which are always to be avoided if possible. Forks should be prevented, especially in species that split easily. If pruning is begun early, forks may be avoided and the crown be trained to almost any shape. When branchlets appear beyond the outline of the crown desired they should be removed with a pole shears in order that the desired shape of crown may be maintained.



DRAWING 1. Shows bad and proper care of the shade tree.

P is a trunk decay due to neglect; GH and F, and CD and AB illustrate the proper way of taking off large limbs; E, limb removed too far from trunk; ON shows where the limb should have been taken off; I and L, limbs properly removed with decay beginning because the wounds were not properly dressed; K is turn buckle which joins the bolts 1 and 2 through the limbs of the crotch.

Drawing 1 is a drawing to show the effect of good and bad pruning. The hole at the base of the tree is the result of some minor injury which was neglected. If it had been promptly treated with an antiseptic dressing the probability is that it would have healed readily, but by neglect a cancerous decay was started which now extends some distance up the trunk, weakening not only the mechanical support of the tree, but cutting off the food supply as well. The wound at "I" shows a limb properly taken off, but after a few years of healing of the wound, which faces the north, sufficient moisture was taken up to start decay, a direct result of not properly treating the wound with antiseptics. The decayed stub on the right shows a limb that was cut off about a foot from the tree which was not able to develop an adventitious bud to assist in the healing process and which permitted decay to begin. This limb should have been taken off at the line "NO," which would have brought the wound closer to the channel of the plastic healing material. A general rule for the removal of branches is to take them off as near the axis of support as possible. When a branch is removed that cannot be supported by the hand when cutting it off, and would split down the stump like the limb at "F," it should be first cut off at "G."

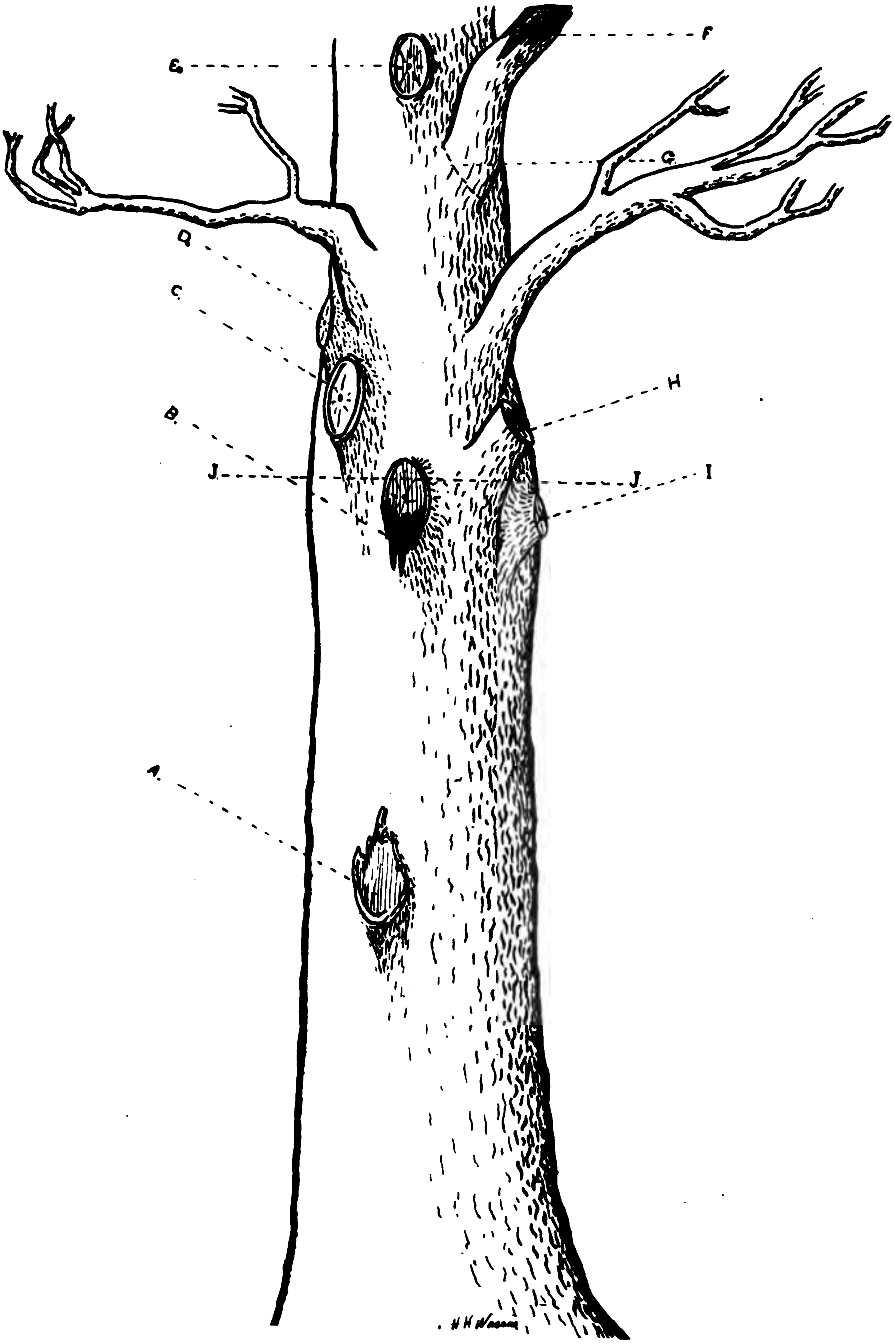
The lines "CD" and "AB" illustrate the correct way of taking off large branches. After the second cut is made the surface of the wound should be made smooth and treated with an antiseptic dressing. The dressing generally used is thin coal tar, although a thick paint of venetian red and linseed oil, or lampblack and linseed oil may be substituted.

The limb cut off at "L" was properly taken off, but decay is beginning in the center of the wound, no doubt due to the fact that the wound was not properly dressed.

The fork is prevented from splitting by a chain attached to bolts which run through each limb and are fastened in the center by a turn-buckle "K."

Drawing 2 is another drawing to illustrate some points on pruning. This tree was injured at point "A." The wound was not cared for, which may be noted by its irregular margin. The chances are that this otherwise healthy tree will develop a body cavity which will eventually spell death.

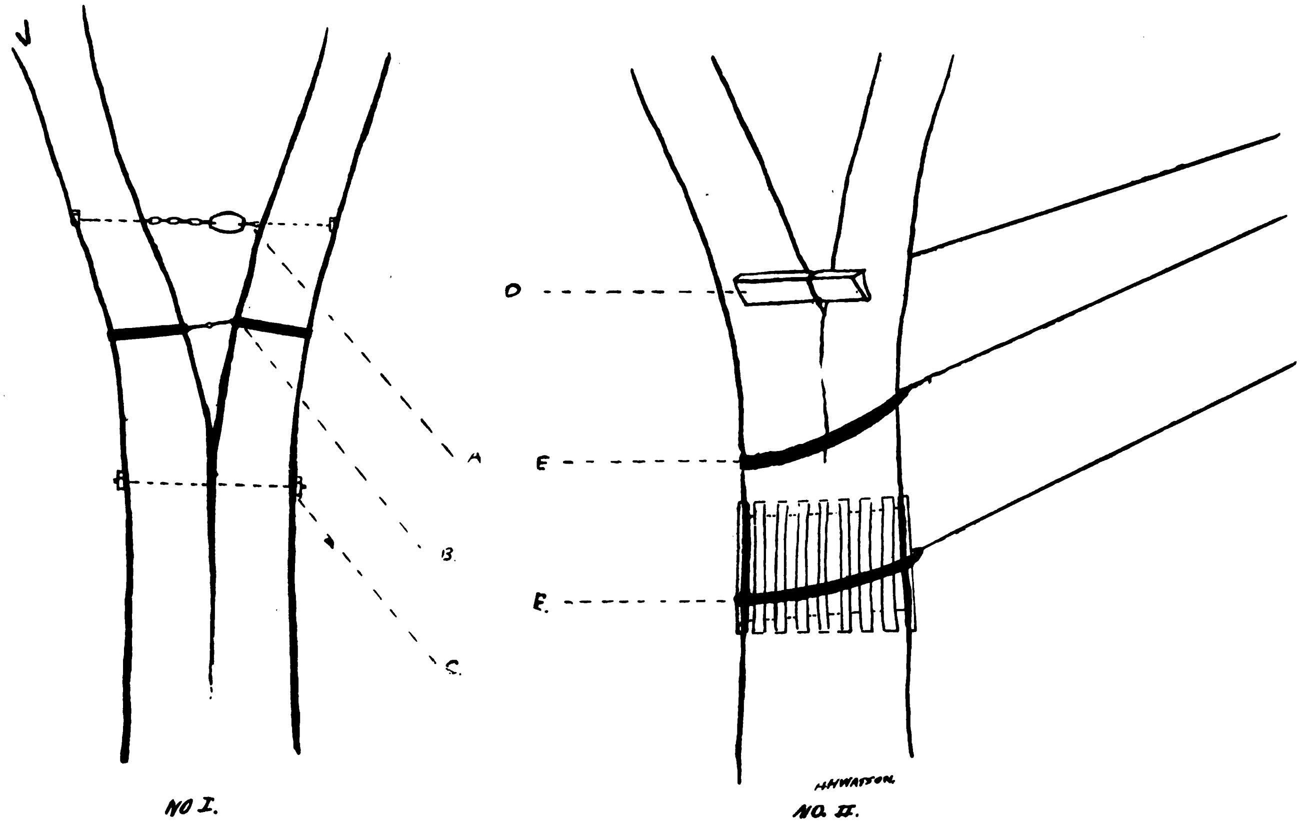
This tree was permitted to head too low and it was found necessary to remove the lower branches, which resulted in the swollen place where the limbs were cut off. If the limbs had been removed



DRAWING 2. Shows effect of removing the limbs from a shade tree that was permitted to head too low.

A, neglected body wound; I, F and H, branches removed too far from the trunk; C, D and E show branches properly removed; B is decay due to neglect of dressing the wound; G shows where the limb should have been taken off.

as is shown at "B," "C," "D" and "E," the tree might have recovered, but it would not have had the form that it would have had if pruned earlier. But in many instances the work will be done as is shown by the letters "I" and "H." The hollow at "F" is the result of cutting off the limb too far from the tree, and making the wound on a horizontal, which started the decay. If the stub remains the decay will soon extend down the trunk of the tree, and for this reason it should be removed at "G."



DRAWING 3. Shows methods used for supporting a fork of a tree and for fastening guy wires to a tree. See text for explanation.

Drawing 3 shows three ways of holding a fork to prevent splitting. The one at "C" shows a single bolt passed through the tree, with nuts on each end. It is obvious that this brace is too low down. The brace to be effective must apply the power farther from the fulcrum of the limb, as is shown at "A." This brace consists of two bolts passing through the limbs with round heads which are sunken just through the inner bark and which are united in the center by a chain and turn-buckle. At point "B" is illustrated an improper means of attaining this end. This consists of fastening two iron bands around the limb and uniting them with a chain, or other device. This in a few years will cut off the nourishment from the limbs, and death ensues.

The same plate illustrates three ways of fastening guy ropes or wires. No property owner should permit his shade trees to be used as a "dead man." There may be instances where it is preferable to have a tree used temporarily for the purpose of attaching guy wires to having a hole dug in the lawn. In this case the temporary use of a tree may not damage it if the wire is attached as is shown at "F," where small strips of wood were placed under the wire. Point "E" shows a wire that has been attached to a tree in such a way that it will soon girdle and kill it. Point "D" illustrates the frequent use of the fork of a tree for support. The use of a tree as a permanent support for a guy wire is to be condemned in every instance.

DAMAGE AND CONTROL OF FUNGOUS AND INSECT PESTS.

The shade tree must undergo many vicissitudes. It is most a marvel that it ever reaches maturity. It is usually planted by a careless person. Menaced at all times by injury from animals and vehicles. Subject to the annual butchering of the tree pruner. Liable to be killed by escaping illuminating gas or electrical discharges from electric wires. Last, but not least, is the danger of attack by hundreds of fungous and insect enemies.

Only a general consideration will be given the fungous and insect enemies of shade trees, because the State maintains a department of entomology, represented by an able corps of men, to whom all inquiries concerning the control of insects should be addressed and specimens of insects sent.

The shade tree pests are increasing, and each year records their wider distribution. In some localities many of the trees have been killed and great numbers partially killed. The damage is usually done before the owner, who is ignorant of insects, knows what is the matter with his trees. In many of the larger cities so many insect pests have become so well established that it appears that in order to control them active and methodical measures will have to be adopted.

On the basis of the methods of controlling shade tree pests, they may be grouped under four heads:

(1) Fungous diseases. Which may be controlled by spraying with lime-sulphur wash or Bordeaux mixture.

(2) Sucking insects, such as aphids, San Jose, cottony maple scale, etc. These may be controlled by spraying with some contact poison, such as kerosene emulsion, lime-sulphur wash or soluble oil mixtures.

(3) Leaf-eating insects. Includes all kinds of beetles and the various kinds of larvæ (worms) which eat the foliage of trees. They may be killed by spraying with some arsenical, such as Paris green, arsenate of lead, etc. The latter is considered the best to use, because it adheres well to the foliage and does not scorch it. Paris green is more extensively used because it is cheaper. The objections to Paris green may be overcome by adding about five pounds of lime to the barrel of the mixture, which will make the Paris green adhere better, assist in holding it in suspension and neutralize any free arsenious acid the Paris green may contain.

(4) Borers of all kinds, such as bark beetles, body borers, etc. There is no one remedy that will apply to this group of pests. They may be killed by cutting them out, traversing the bore with a flexible wire and impaling the borer, injecting the bore with some fluid, such as disulphide of carbon, etc. Do not "squirt" coal oil or turpentine into the bores.

In all cases when the correct method of destroying the enemy is not known it is best to write the state entomologist, who will give you specific instructions how to control it. In many instances your local dealer in insecticides may be able to furnish you with the desired information. Remember that the success of spraying depends upon using the right kind of material, applying it thoroughly. and at the right time.

MUNICIPAL OWNERSHIP AND MANAGEMENT OF SHADE TREES.

For a solution of the shade tree problem we must look to municipal ownership. Until then we can not expect uniformity in the planting of trees, their proper management, or the control of their insect enemies.

It is suggested that each city and town of the State be empowered to have a shade tree and park commission, to consist of three members, one of whom shall be known as the ''tree warden'' or ''city forester.'' The city forester shall be a graduate of a recognized school of forestry or show evidence of a technical knowledge of forestry and forest entomology. The technical qualifications are insisted upon since the lack of them is responsible for the present condition of our shade trees. Men who honestly think they know how to take care of a tree are frequently ignorant of the rudiments of plant physiology. For example, one of our largest cities was visited this fall and the park commissioner was asked if he sprayed any of the city trees. He replied that they were not bothered with insects. In the same city on the same day large specimens of basswood were being cut down because they had been killed by the cottony maple scale, and all the elm and maple in the same block were practically dead. Conversation with this man revealed the fact that he was ignorant of forest entomology, insecticides, plant physiology, etc.

The shade tree and park commission should have complete control over all matters relating to shade and park trees. They should have the power to decide on what streets trees should be planted, how spaced, and have the power to plant, prune and spray them. They should have the power to ornament all public property, such as parks, boulevards, schoolyards, courthouse yards, etc. They should have the power to remove existing trees or to thin them where too thick. They should have equal authority over new additions to the city, though such additions have not been incorporated. Experience of shade tree commissions of some of the eastern cities show that the city can spray a tree for one-half what it would cost the property owner.

The salaries of the commission should be paid by the city, and the expense of all the work they do should be borne by the city, except the cost of planting the trees, which should be assessed against the property. As would be expected, such a law would meet with some objections, for it is hard for some selfish individuals to cede rights and privileges for the public good.

This office receives numerous inquiries concerning the present laws governing shade trees, and concerning the privilege and authority that telephone companies, etc., have to erect and to maintain their lines. People forget that the city owns the streets and alleys, and has control over the land adjacent to the streets as far as the property line, which usually includes all shade trees. The city council grants telephone companies a franchise to erect and maintain their poles and wires without making any provision for protecting the shade tree, which leaves the property owner at the mercy of the "linemen."

For this reason a copy of the existing laws relating to the preceding inquiries is here appended:

(Acts 1905, p. 678. In force April 15, 1905.)

Vines or Trees—Injury.

Sec. 2308 (2059), p. 414: Whoever cuts down or destroys, or by girdling or any other means injures any standing or growing vine, bush, shrub, sapling or tree on the land of any other person, or on land belonging to the State, or to any county or township therein, or on any land reserved or granted for the use of schools or colleges, without a license so to do from competent authority, or whoever, without such license, shall cut down or remove from any such lands, or from lands belonging to the United States, any tree, stone, timber or other valuable article, is guilty of a trespass, and, on conviction, shall be fined in five times the value of such property, to which may be added imprisonment, not exceeding twelve months in the county jail.

Trees on Highway—Injury.

Sec. 2310 (2061), p. 416: Whoever shall wilfully, maliciously or mischieviously, and without right, cut down or in any way injure any tree on the public highway, shall on conviction, be fined not less than five dollars nor more than five hundred dollars.

Military and Fire Companies.

Sec. 4293 (4590), p. 8: To organize military or fire companies; also companies to erect suitable buildings for public meetings, and to plant and protect shade trees in public grounds or spaces in towns and cities.

Control of Lawns and Trees Along Streets.

Sec. 8888 (3709), p. 234: Every city and town is hereby invested with full power to regulate the planting, maintaining and production of shade trees and lawns along the streets and in the public grounds of such city or town; and such city or town is given full power to compel the owners of lots and parcels of ground bordering on any such street, alley, public square or common, to plant, maintain and protect shade trees and lawns, under the same regulations and in the same manner as grading, paving and other improvements of streets and sidewalks are now enforced; and the expense of such improvements, when so ordered by ordinance of such city or town, shall be a lien on such lots and parcels of ground and be collected in the same manner as assessments for street improvements. All laws for the improvement of streets in cities and towns are hereby made applicable to the improvements provided for in this section.

(Acts 1905, p. 232. In force April 15, 1905.)

Trustees—Powers Defined.

Sec. 9005 (3797), p. 31: The board of town trustees shall have the following powers:

Seventeenth. To plant trees upon public grounds and along the streets of such town, and provide for their culture and preservation.

(Acts 1905, p. 680. In force April 15, 1905.)

Shade Trees—Destroying or Injuring.

Sec. 2316 (2065), p. 420: Whoever unlawfully removes, destroys, cuts or girdles any shade tree, or carries off or removes or in any wise injures the protecting box of any shade tree, in any city, town or village of this State, or in any public highway, shall be fined not less than three dollars nor more than fifty dollars; but this section shall not be so construed as to prevent any owner of grounds from making any necessary alterations in the walks or trees on or adjacent to such grounds.

An Act concerning highways. (Approved March 1, 1905.)

Poles, Wires, Etc.

Sec. 38. That corporations organized for the purpose of constructing, operating and maintaining telephone lines and telephone exchanges are authorized to set and maintain their poles, posts, piers, abutments, wires and other appliances or fixtures, upon, along, under and across any of the public roads, highways and waters of this State, outside of cities and incorporated towns; and individuals owning telephone lines are hereby given the same authority: *Provided,* That the same shall be erected and maintained in such manner as not to incommode the public in the use of such roads, highways and waters: *Provided, also,* That no pole or appliance shall be so located as to interfere with the ingress or egress from any premises on said road, highway or waters: *Provided, fur-*

ther, That nothing herein contained shall be construed as depriving the county commissioners of any county of the power to require re-location of any such pole, poles or appliances which may affect the proper uses of such highway for public travel, for drainage, or for the concurrent use of other telephone lines; that the location and setting of said poles shall be under the supervision of the board of commissioners of the county.

Silvicultural Qualities of Shade Trees.

On pages 124 and 125 a table of the silvicultural qualities of shade trees is given to assist in the selection of suitable shade trees.

In the table + represents the maximum of the quality at the head of the column; × represents the intermediate degree, and 0 represents the minimum degree of the quality.

	Long Lived.	Requires Very Moist Soil.	Requires Medium Moist Soil.	Requires Dry Soil.	Leaves Appear Early.	Leaves Fall Late.	Tree Tall.	Tree Medium Height.	Tree Low.	Crown Broadly Oval.	Crown Long and Narrow.	Slow Growing.	Rapidly Growing	Tolerant of Smoke and Gas.	Subject to Deadly Insects.	Other Insects and Diseases.	Twigs, etc., Make Litter.	Other Objections.
Ailanthus	×	+	+	+	×	+	0	×	+	+	0	0	+	+	0	0	0	0
Ash (white)	+	×	+	×	×	×	+	×	0	×	0	0	+	×	0	×	0	0
Ash (mountain)	×	×	+	×	×	×	0	×	+	+	0	×	×	×	0	×	0	0
Box Elder	×	×	+	×	+	×	×	+	0	×	×	0	+	0	+	×	0	×
Catalpa (speciosa)	×	+	×	0	0	+	0	×	0	×	0	0	+	+	0	×	0	×
Catalpa (bignonioides)	×	+	×	0	0	+	0	×	+	+	0	0	+	×	0	×	+	×
Elm (white)	+	+	×	0	+	+	+	×	0	+	0	0	+	×	+	×	0	0
Hackberry	+	+	×	0	×	×	+	×	0	×	0	×	×	×	0	×	0	0
Horse Chestnut	×	×	+	×	×	×	0	×	+	+	0	×	×	×	0	×	0	0
Koelreuteria	+	×	+	+	×	+	0	×	+	+	0	×	×	×	0	0	0	0
Linden or Basswood	+	×	+	×	+	×	+	×	0	×	0	×	×	×	+	×	×	0
Locust (black)	+	0	×	+	×	×	+	×	0	×	0	0	+	×	+	×	×	0
Locust (honey)	+	+	×	0	0	×	+	×	0	×	×	×	×	×	0	×	×	0
Magnolia (acuminata)	+	×	+	×	×	+	+	×	0	×	+	×	+	+	0	0	0	0
Maple (hard)	+	0	×	+	+	+	+	×	0	+	0	+	0	×	+	0	0	0
Maple (Norway)	+	0	+	×	+	+	0	×	+	+	0	+	0	×	×	×	0	0
Maple (soft)	×	+	×	×	+	+	×	+	0	+	0	0	+	×	+	0	0	0
Oak (palustris)	+	+	×	0	0	+	+	×	0	×	×	×	×	×	0	×	0	0
Oak (rubra)	+	+	×	0	0	+	+	×	0	×	0	×	×	×	0	0	0	0

Oriental Plane	+	+	×	×	×	+	+	×	0	×	×	0	+	×	0	0	×	0
Osage Orange	×	×	×	×	0	+	0	×	+	+	0	×	×	+	×	0	×	0
Paulownia	×	×	×	0	0	×	0	×	+	+	0	×	×	×	0	0	0	+
Poplar (Carolina and Lombardy)	0	+	+	×	×	0	+	×	0	0	+	0	+	0	×	0	×	×
Poplar (silver leaf)	×	×	+	+	+	+	×	+	0	+	0	0	+	×	0	×	0	×
Sweet Gum	+	+	×	0	+	+	+	×	0	×	×	×	×	×	0	0	×	0
Sycamore	+	+	+	×	×	×	+	×	0	×	×	0	+	×	0	×	×	0
Tulip tree	+	×	+	×	×	×	+	×	0	×	×	0	×	0	0	×	0	0
White Willow	×	+	×	0	+	+	×	+	×	+	0	0	+	×	×	0	0	0

Wood-Lot Conditions and Possibilities. II.

BY STANLEY COULTER, MEMBER OF THE BOARD.

Since the publication of the last report of the State Board of Forestry a more extended and careful study has been made of wood-lot conditions in Indiana. The results of this supplementary survey not only emphasize the statements made in the paper[1] under the above title in that report, but also reveal the fact that the conditions were even worse than were indicated.

It was found that selective cutting had eliminated all high-grade species with the exception of isolated trees or small groups, and further, that the increasing demand for lumber had resulted in the practically complete removal of all of the larger and straighter trees of the less desirable species. The result is that at present our wood lots really represent, in the main, not merely second-class species, but undesirable individuals of those species. The individual trees of considerable size still remaining have been left because they were misshapen or twisted or otherwise undesirable for lumber. The inference is plain, namely, that the future forest will consist of the progeny of undesirable individuals of second-class species unless remedial methods are promptly formulated and intelligently applied.

As a rule trees must reach a considerable age before they produce seeds of the best quality; that is, seeds showing a high germination percentage and capable of giving rise to healthy and vigorous seedlings. Of course this age varies with the species, and, to a certain extent, with the conditions. In the more rapidly growing forms, such as the cherry and catalpa, it is approximately from twenty-five to thirty years, while in species of slower growth, such as the oaks and hickories, it reaches from fifty to seventy years. The most cursory examination of almost any wood-lot will show that seed trees of this age are practically entirely wanting. In the few cases in which such trees are found, they are often so imperfectly distributed as to preclude any possibility of the regeneration of the area without artificial reinforcement.

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[1] **Stanley Coulter—Wood-Lot Conditions and Possibilities. Report Indiana State Board of Forestry, 1909. pp. 37-46.**

Experience has shown that the best seeds are produced by the best trees, that is, those that are healthy, vigorous, rapidly growing and well-shaped. It is very difficult to find such trees in any wood lot at present, but until they do occur in sufficient numbers and in the proper distribution to insure natural seed regeneration, it must be recognized that artificial reënforcement is an absolute necessity if even the present stand is maintained. In the less run-down wood lots this artificial reënforcement would be neither difficult nor expensive. In such cases an antecedent cutting away of the brush and weeds from the immediate neighborhood of seed trees and perhaps a clearing away of the "duff" sufficiently to expose the mineral soil would ordinarily prove sufficient. In other cases it might be necessary to plant the seeds of desirable species in open places in the tract if a prompt regeneration is secured. If the inspection of wood lots during the past two years has revealed average conditions, it will be found necessary in the great majority of cases to do more or less planting if satisfactory results are obtained.

It must be kept clearly in mind that not only have our forests deteriorated in the amount, the size and the quality of timber they produce, but also that the composition of the forests, that is, the proportion which the different species bear to each other, has varied greatly, and that in most instances this variation has been in the direction of deterioration. When the greater amount of the stand of the wood lot is made up of less desirable species, such as black oak, beech and red maple, with an undergrowth of ironwood, haw, dogwood and similar forms, it is not wise nor would it prove profitable to trust to natural seed regeneration. Where such conditions exist reënforcement is indicated, and through this reënforcement desirable species may be introduced and the desired proportion of species established.

The successive operations leading to present wood-lot conditions are not difficult to trace. When lumbering began in Indiana only the best trees of the most valuable species had a market value, and, as a consequence, these only were cut. Defective trees and those of inferior species having no market value were left. Later, as the demand for lumber became greater, and smaller material became valuable, the forest was again cut over and again only the best was taken. Through repeated selective cuttings a condition was reached in which the forest contained practically nothing but defective trees or unmerchantable species. If we add to years of destructive cutting of this sort an almost universal over-pasturage and an absolute absence of protective measures and improvement cuttings in the way of cleanings and thinnings, we have a sufficient explanation of present wood-lot conditions in the State.

A somewhat careful study of a few tracts which were taken as fairly typical gave indications that the growth of wood per acre did not exceed seventy or eighty feet B. M. per year. This is not more than one-fourth the growth that might be secured if the wooded tracts were intelligently handled.

The attempt has been made in the article of last year, and also in this present one, to state without exaggeration the actual condition of the wood lots of the State, to determine if possible the causes bringing about this condition and to indicate as far as possible the economic significance of this practically universal deterioration of our wooded areas. If these conditions are improved in any marked degree it will be because of intelligent and persistent effort. It goes without saying that the splendor of our primeval forests can never be attained however painstaking and persistent our efforts may be. It is equally true, however, that a better proportion of species, a better quality of wood, a denser stand, a more rapid growth rate and an increased area of timber land may be secured by the use of proper methods. If progress is made it must be in the main along the lines discussed in the succeeding paragraphs.

I. EDUCATION.

No very effective work can be hoped for until there is a more general realization of the value of the wood lot. This value may consist either in its direct value as a producer of wood for the farm or market, or in some of its indirect values, such as the prevention of the waste of land by erosion, the protection of the headwaters of streams, or as a wind-break. Until this present and potential value is clearly realized, wooded areas will continue to be cleared or left uncared for or destroyed by overgrazing. Concerning practically every other crop, the land owner of today has accurate knowledge. He is in command of scientific methods, he knows the exact needs of the crop and is quick to recognize the appearance of any of the perils to which it is exposed. Concerning the tree crop, he is, almost without exception, absolutely ignorant. If the direct values only are considered, he has no knowledge of the amount of his crop or the board feet it will cut, he is ignorant of its quality and in most cases of its market price. Further he has no knowledge of the special uses to which different species are put nor of the methods of dissection in order to secure the largest returns. But, it may be repeated, little improvement in wood-lot conditions can be hoped for until such knowledge becomes general among land owners. This knowledge of the value of the wood lot as a whole must be supplemented by a full knowledge of the silvical qualities of at least the more important economic species. It must be recognized that the different species have different light, soil and moisture requirements; different degrees of susceptibility to insect attack and fungous disease; different growth rates, and so through a long series of facts which must be within his possession if he manage his wood lot in such a way as to secure the maximum results.

This education must reach out into a clear recognition of the fact that a wood lot or a planting must have care and protection if the best results are to be obtained. It must be understood that care and protection are as essential in securing a good tree crop as in the case of any other crop. An examination of the records of the results of different methods of cultivation and care of experimental tracts at the State Forest Reserve, set out in detail in another part of this report, will show conclusively how certainly and how vigorously trees respond to such treatment. It can not be too often repeated or too strongly emphasized that there is no more probability of raising a good tree crop without care and cultivation than of raising a good corn crop without plowing. Unless wood-lot owners recognize the truth of this statement the utter depletion of our wood lots is a matter of the near future.

This education should emphasize the almost criminal folly of waste of land. The aggregate amount of uncultivated land in the State is enormous, running up into hundreds of thousands of acres. great stretches of hills denuded of their timber growth, their soil washed away and the surface deeply furrowed by erosion occur and the shamefulness of such waste is realized. But probably these hill areas that are waste do not aggregate so great an area as do the smaller and less apparent waste areas on individual farms, even in our most highly cultivated regions. These small areas, because of difficulty of access, or character of soil, or topography, or for some other cause, are never tilled, and it is areas such as these that should be utilized for tree planting. The complete utilization of the land is the most striking feature of European agriculture in contrast with our own. As an incident, the weed problem in Indiana would be practically solved if these waste places were wisely treated.

In the wood lots themselves there occur open places in which neither soil nor light is doing useful work. Every such space should be filled with some desirable species, not only because of the increased value of the stand that would be brought about, but also to preclude the occupancy of the soil by worthless or positively harmful species. It is amazing, when we consider the high value of land to find the enormous acreage in our State that is absolutely unutilized. There can be no advance in forestry and but little further advance in agriculture until this land waste becomes a thing of the past.

No less criminal is the waste of wood material seen wherever a cutting is going on. Waste in the using of saw timber for fuel; in using a high-grade species where the purpose would be equally served by using one of less value; in failure in fully utilizing all the material cut; in impairing the future of the forest through injury to the young growth in logging operations; through carelessness in providing protection against fire and in countless other ways, most of which, sadly enough, can be seen on any farm in any part of the State. The most efficient conservation of our forests will take place through a reduction of the annual cut because of the elimination of unnecessary waste and the full utilization of the material cut.

Each wood-lot owner for the protection of his own interests should educate himself as to the value of wood lots, the silvical qualities of the various species of economic trees, the necessity of care and protection and the high economic importance of eliminating unnecessary waste either of land or material. Unfortunately this first step, which is absolutely fundamental, if wood-lot and forest conditions are improved, is the most difficult of all to take. Planting after planting in Indiana has failed simply because those undertaking the work were ignorant along the lines just indicated. It will be many years before wood-lot owners as a class have this knowledge and in those years our wooded areas will become still further depleted and the work of restoration be made proportionately greater. That such knowledge is essential to a wise management of the land and to securing from it the greatest possible returns is an indisputable fact. It is very fortunate that much information bearing upon the points discussed has been collected by the State Board of Forestry and can be obtained by addressing the secretary.

II. IMPROVEMENT CUTTINGS.

In by far the larger number of cases the first step in the improvement of the wood lot is the institution of a series of improvement cuttings. These cuttings should first remove all dead and defective trees. This work may properly constitute a single operation. This should be followed by the gradual removal of worthless and inferior forms which occupy the soil to the exclusion of more valuable species. There is a constant tendency to make this cleaning consist of a single operation. If, however, the underbrush and inferior species are abundant such a wholesale cleaning defeats its own purpose. The sudden exposure of large areas to the direct action of the sun very speedily brings the soil to a condition in which the germination of tree seeds is a practical impossibility. As suggested in the paper of last year, if the undergrowth is at all thick, probably not more than one-fourth of it should be removed at the first cleaning-cutting, and the tract should not receive a second cutting until two or three years had elapsed. This cleaning should include trees which are insect infested or show fungous growth of any sort. Wood lots are not uncommon in which practically every tree is more or less covered with shelf fungi or affected with black knot. Such a condition indicates that the tree first attacked was not removed in a cleaning cutting, but remained to serve as a center of infection from which the disease spread over the entire tract.

During the periods in which the cleanings are going on, ''thinning'' cuttings may be made when conditions demand. Thinnings consist in the removal of trees of valuable species which are so placed as to prevent proper development if all are allowed to stand. Great care must be exercised in selecting the trees for removal in thinning, but no operation means more in the long run for the improvement of the wood lot. It is no more possible to raise good trees without cleanings than it is to have a good garden when weeding has been absolutely neglected. It is as necessary to thin trees as it is to thin corn where crowding makes a perfect development possible. Nothing would so rapidly improve the condition of our woodlands and nothing yield such quick returns as wisely planned and carefully executed improvement cuttings.

III. RE-ENFORCEMENT.

It will be found in very many instances that the land could carry a much larger number of trees than it does. This means either that there are unoccupied spaces or that the ground is occupied by a worthless undergrowth. In every such case the density of the stand should be increased by planting in the unoccupied spaces. This planting can be easily done by loosening the earth with a stick or some pointed tool, dropping the seed in the hole thus made and then gently firming the earth by pressure with the foot. This process is known as "dibbling." There is no antecedent preparation of the ground, no attempt to plant in rows, merely a utilization of the spaces which have not been filled by natural seed regeneration. The seeds used in this work should, as a rule, have been collected by the wood lot owner from healthy, well-shaped and vigorous trees of suitable age growing in the immediate region. Such seeds have a good ancestry and are already adapted to the locality. The seeds should be plump, of good color and of standard weight. Seeds which have been collected for over a year should be avoided, since tree seeds lose germinative power quite rapidly. Care should also be taken not to plant too deeply. For the larger seeds an inch to an inch and a half is ample, while for the smaller seeds the slightest possible covering of earth is the best practice. No method of increasing the density of the stand is so economical or gives such satisfactory results. It has been used for years in the great Baltimore forests by Dr. Schenck and is practiced to a greater or less extent by every successful forest manager. It would be interesting to know how many wood-lot owners in Indiana have attempted to increase the density of the stand of timber in any purposeful way.

Reënforcement is also indicated when the proper proportion of species does not exist. The stand may be sufficiently dense, but the number of trees of inferior species may be much too large. Practically the only way in which a desired proportion can be secured is by planting in the method indicated. In extreme cases it may be necessary in addition to the planting to destroy seed trees of undesirable species in order to secure the desired proportion. No wood lot has been inspected in which any attempt had been made to change the composition by planting desirable species and by removing seed trees of species that were undesirable or unmarketable. It is evident, however, that in a relatively short time a very great improvement might be made in both the quality and density of the stand.

IV. REPRODUCTIVE CUTTINGS.

This process is so clearly outlined in a recent report by F. W. Besley[2] that his statement is directly quoted: "Reproduction cuttings should be made in old stands where there is insufficient young growth. This could be accomplished by thinnings in the stand to let in light and to favor seed production and seed germination; then as seeding is accomplished the parent trees may be removed to give the young seedlings full opportunity for their best development." There are many wood lots in Indiana in which overmature trees have been allowed to remain, resulting in almost every case in an insufficient young growth. It is in cases such as these that reproductive cuttings are indicated. The fact should be recognized that overmature trees are deteriorating in value from year to year, as well as holding in check the young growth. It is a mistaken conservation or a mistaken thrift which leads to their retention. It is as foolish to permit a tree to stand after it is ripe and ready for the ax as it would be to permit wheat or corn to stand long after they were ripe and ready for the harvest. Reproductive cuttings are indicated in a very large proportion of the wooded areas in the southern counties of the State. The belief that the quality of the timber is enhanced by allowing it to grow in the midst of a dense undergrowth or to remain for years "suppressed" by the shade of overmature trees is not borne out by the facts. It is not difficult to recognize the conditions which indicate reproduction cuttings, and wherever these conditions exist prompt action should be taken.

V. PROTECTION AGAINST FIRE.

The composition of our forests, their sparse stand and their scattered positions preclude the danger of great and widespread fires. This very immunity, however, has led to a practical neglect of all precautions against the small fires which recur with absolute certainty each year in every part of the State. In the aggregate the losses resulting from these small fires amounts each year to over one hundred thousand dollars, if we consider only the direct value of the timber. When it is recalled, however, that most of these fires are ground fires and are usually not of sufficient magnitude to seriously imperil large trees, it will be readily seen that the greatest damage is that which is never computed and rarely considered, namely, the damage to the seedlings and young trees. Improvement cuttings, reënforcement, reproductive cuttings, will all go for naught if the young growth is destroyed each year by fire. It is therefore necessary for the wood-lot owner to realize the losses referrable to fire and to safeguard his holdings with extreme care. Very fortunately the fire laws of Indiana are excellent, if by any chance they might be enforced. Every wood-lot owner should be familiar with these laws and should invoke them for his protection whenever the occasion demands. A vigorous enforcement of the fire laws as they exist would practically eliminate this danger.

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[2] F. W. Besley.—The Plant Life of Maryland. The Forests and Their Products Vol. 3, Maryland Weather Service, p. 369.

VI. WITHDRAWAL OF WOOD LOTS FROM PASTURAGE.

It is very plain that so long as the wood lots are universally used for pasturage there will be a steady deterioration in their quality. The rapidity of this deterioration will depend in a very great measure upon the closeness of the pasturage. Over-pasturing is and has been the rule for years and the deterioration of our wood lots is patent to the most casual observer. Pasturing produces a deterioration of the wood lot in two ways. First, in injury to mature trees through the compacting of the soil, through injuries to the trunk, and in numerous other self-evident ways. The compacting of the soil reduces the amount of contained oxygen, changes its water capacity and in other ways checks tree growth, and in some cases brings about their death. Some species, notably the tulip tree or yellow poplar, are especially sensitive to the changed conditions resulting from pasturing and show its effects even when it is very light. Second, to the young growth. This is practically absolutely wiped out from every pastured tract. It is true that some tree species are not eaten by cattle except when "starving hungry," but observation of Indiana wood lots seems to indicate that with us pasturing cattle are always starving hungry, since every tree species is browsed down. When there is the purpose of insuring the perpetuation of the forest by fostering young growth, cattle must be rigidly excluded from the tract.

It is perhaps too much to expect the withdrawal of all wood lots, or any considerable number of them, from use as pastures. It should not, however, be beyond hope that in many cases at least portions of the wood lot might be freed from the burden of pasturing and permitted to develop in a normal way. Selection should be made from every wood lot of a portion showing the best soil, the best stand and the best proportion of species. In this portion improvement cuttings, reënforcement and reproductive cuttings should be practiced and a careful protection maintained against fire and other dangers. It is only in this way that there is possibility of restoring our wooded areas to a condition in which the demands made upon them can be met. At the best tree growing gives slow and relatively small returns. When these conditions are not at least approximated it is an economic absurdity to hold valuable land as wood lots.

These methods of improving existing conditions are all but axiomatic, but there is need for their constant repetition with constantly increasing emphasis. The future of the wood-working industries of Indiana lies almost wholly in the hands of owners of wood lots. By wise management of these areas the future is assured. A continuance of present methods means the failure of these and dependent industries within a very few years.

Phenological Records for Indiana.

Collected by Local Office Weather Bureau, U. S. Department of Agriculture, Indianapolis, Ind

RICHMOND, WAYNE COUNTY.

YEAR.	SPECIES.	First Leaves.	Woods Green.	Leaves Coloring.	Leaves Falling.	Woods Bare.
1904	Maple	May 6	May 21	Oct. 6	Oct. 16	Oct. 21
	Elm	May 7	May 28	Oct. 16	Oct. 21	Oct. 26
	Oak	May 9	May 29	Oct. 16	Nov. 1	Nov. 16
1905	Maple	Apr. 23	May 4	Oct. 10	Oct. 14	Nov. 2
	Elm	Apr. 30	May 6	Oct. 10	Oct. 18	Nov. 1
	Oak	May 11	May 17	Oct. 12	Oct. 20	Nov. 5
1906	Maple	Apr. 29	May 5	Oct. 15	Oct. 12	Oct. 20
	Elm	Apr. 28	May 10	Oct. 14	Oct. 12	Oct. 16
	Oak	May 3	May 15	Oct. 19	Oct. 24	Oct. 29
1907	Maple	May 3	May 20	Oct. 26	Oct. 13	Nov. 17
	Elm	May 6	June 18	Nov. 13	Oct. 17	Nov. 17
	Oak	May 16	June 12	Nov. 20	Oct. 30	Nov. 30
1908	Maple	Apr. 21	May 5	Oct. 20	Nov. 10	Nov. 20
	Elm	Apr. 19	May 8	Nov. 7	Nov. 17	Nov. 20
	Oak	May 1	May 10	Nov. 10	Nov. 29	Nov. 30
1909	Maple	May 6	May 20	Oct. 30	Nov. 20	Nov. 26
	Elm	May 4	May 22	Nov. 10	Nov. 24	Nov. 28
	Oak	May 17	June 7	Nov. 14	Nov. 26	Nov. 30

LAFAYETTE, TIPPECANOE COUNTY.

1904	Maple	Apr. 27	May 13	Sept. 19	Oct. 1	Nov. 6
	Elm	Apr. 30	May 9	Oct. 26	Nov. 3	Nov. 11
	Oak	May 4	May 22	Oct. 31	Nov. 7	Nov. 18
1905	Maple	Apr. 6	....	Sept. 20	Oct. 1	Nov. 10
	Elm	Apr. 21	May 5	Sept. 30	Oct. 10	Nov. 15
	Oak	Apr. 30	May 5	Oct. 1	Oct. 15	Nov. 15
1906	Maple	Apr. 2	May 1	Sept. 27	Oct. 10	Oct. 27
	Elm	Apr. 6	May 1	Oct. 10	Oct. 15	Nov. 6
	Oak	Apr. 12	May 1	Oct. 15	Oct. 5	Nov. 20
1907	Maple	Mar. 25	May 20	Sept. 25	Oct. 19	Nov. 5
	Elm	Apr. 28	May 20	Oct. 1	Oct. 30	Nov. 5
	Oak	May 10	May 20	Oct. 8	Oct. 25	Nov. 5
1908	Maple	Apr. 10	May 2	Sept. 3	Sept. 20	Nov. 1
	Elm	Apr. 18	May 15	Aug. 20	Sept. 1	Nov. 1
	Oak	Apr. 26	May 15	Oct. 1	Oct. 1	Nov. 1
1909	Maple	Apr. 20	May 15	Sept. 25	Oct. 1	Nov. 12
	Elm	Apr. 15	May 15	Sept. 10	Sept. 18	Nov. 12
	Oak	May 1	May 15	Oct. 1	Oct. 12	Nov. 30

BLOOMINGDALE, PARKE COUNTY.

YEAR.	SPECIES.	First Leaves.	Woods Green.	Leaves Coloring.	Leaves Falling.	Woods Bare.
1904	Maple	Apr. 23	May 12			
	Elm	May 3	May 12			
	Oak	May 9	May 12			
1905	Maple	Apr. 15	May 8			
	Elm	Apr. 25	May 8			
	Oak	May 4	May 8			
1906	Maple	Apr. 27	May 16			
	Elm	Apr. 30	May 16			
	Oak	May 13	May 16			
1907	Maple	Apr. 2	May 23			
	Elm	Apr. 24	May 23			
	Oak	May 13	May 23			
1908	Maple	Apr. 21	May 1	Oct. 15	Oct. 25	Nov. 15
	Elm	Apr. 22	May 1			
	Oak	May 3				
1909	Maple	Apr. 24	May 15		Oct. 20	Nov. 1
	Elm	May 3	May 15		Oct. 20	Nov. 1
	Oak	May 10	May 15		Oct. 20	Nov. 1

PRINCETON, GIBSON COUNTY.

1905	Maple	Apr. 7				
	Elm	Apr. 10				
	Oak	Apr. 16				
1906						Nov. 15
1907	Maple	Apr. 1		Sept. 20	Nov. 15	Nov. 25
	Elm	Apr. 6		Oct. 10		Nov. 25
	Oak	Apr. 25		Nov. 1		Nov. 30
1908	Maple	Apr. 6				
	Elm	Apr. 9				
	Oak	Apr. 18				
1909	Maple	Apr. 1	Apr. 6	Oct. 20	Nov. 10	

SOUTH BEND, ST. JOSEPH COUNTY.

1904	Maple	May 6	May 8			
	Elm	May 5	May 8			
	Oak	May 8	May 10			
1909	Maple	May 9				
	Elm	May 13				
	Oak	May 16				

MADISON, JEFFERSON COUNTY.

1905	Maple	Apr. 6	May 26			Oct. 20
	Elm	Apr. 20	May 11		Sept. 1	Nov. 1
	Oak	Apr. 30	May 12		Oct. 20	
1906	Maple	Apr. 12	May 1			Nov. 1
	Elm	May 1				Nov. 1
	Oak	May 5				Nov. 1
1907	Maple	Mar. 28	Mar. 30	Sept. 30	Oct. 30	Oct. 30
	Elm	Mar. 20	Mar. 30	Sept. 15	Oct. 1	Oct. 30
	Oak	Mar. 21	Mar. 30	Sept. 1	Oct. 1	Oct. 30
1908	Maple	Apr. 15	May 10	Oct. 1	Oct. 10	
	Elm	Apr. 28	May 10	Sept. 20	Sept. 25	
	Oak	Apr. 30	May 10	Oct. 10		
1909	Maple	Apr. 20		Sept. 15	Oct. 20	
	Elm	Apr. 29		Sept. 10	Sept. 30	
	Oak	May 1		Sept. 20	Nov. 1	

NORTHFIELD, BOONE COUNTY.

YEAR.	SPECIES.	First Leaves.	Woods Green.	Leaves Coloring.	Leaves Falling.	Woods Bare.
1904	Maple	Apr. 4				
	Elm	Apr. 8				
	Oak	Apr. 20				
1905	Maple	Apr. 10	May 15	Oct. 10	Oct. 25	
	Elm	Apr. 10	May 15	Oct. 10	Oct. 25	
	Oak	Apr. 25	May 15	Oct. 10	Oct. 25	
1906	Maple	Apr. 25	May 5			Nov. 1
	Elm	May 1				
	Oak	May 1				
1907	Maple	May 1	May 20	Oct. 15	Oct. 15	
	Elm	May 1				
	Oak	May 10				
1908	Maple	Apr. 25		Oct. 1	Oct. 15	Nov. 15
	Elm	May 1				
	Oak	May 10	May 10			

MOORES HILL, DEARBORN COUNTY.

1905	Maple	Apr. 18	May 10		Oct. 10	Nov. 15
	Elm	Apr. 9	May 10	Sept. 1		Nov. 15
	Oak	Apr. 27	May 10			Nov. 15
1906	Maple	Apr. 20	May 4			Nov. 15
	Elm	Apr. 20	May 4		Oct. 19	Nov. 15
	Oak	Apr. 26	May 4			Nov. 15
1907	Maple	Apr. 25	May 22	Oct. 1	Nov. 10	Nov. 20
	Elm	Apr. 28	May 22	Oct. 5	Oct. 15	Nov. 20
	Oak	Apr. 29	May 22	Oct. 20	Oct. 28	Nov. 20
1908	Maple	Apr. 15	May 15	Oct. 5	Oct. 15	Nov. 10
	Elm	Apr. 12	May 15			Nov. 10
	Oak	Apr. 21	May 15			Nov. 10
1909	Maple	Apr. 20	May 15	Oct. 1	Sept. 15	Nov. 18
	Elm	Apr. 28	May 15			Nov. 18
	Oak	May 5	May 15	Oct. 15		Nov. 18

GREENCASTLE, PUTNAM COUNTY.

1904	Maple	Apr. 26		Oct. 1	Oct. 15	Nov. 14
	Elm	May 1			Oct. 1	Nov. 14
	Oak			Oct. 20	Nov. 1	
1905	Maple	Apr. 5	May 6			
	Elm	Apr. 22	May 6			
1906	Maple	Apr. 20		Sept. 30	Oct. 11	Oct. 28
	Elm	Apr. 23		Oct. 7	Oct. 11	Oct. 28
	Oak	Apr. 26		Oct. 10	Oct. 11	Oct. 28

WARSAW, KOSCIUSKO COUNTY.

1904	Maple	May 9	May 25	Sept. 22	Nov. 5	Nov. 25
	Elm	May 15	May 25	Sept. 22	Nov. 5	Nov. 25
	Oak	May 22	May 25	Sept. 22	Nov. 5	Nov. 25
1905	Maple	Apr. 20	Apr. 22	Oct. 15	Nov. 1	Nov. 25
	Elm	Apr. 30	May 12	Oct. 25	Nov. 3	Nov. 25
	Oak	May 5	May 12	Oct. 25	Nov. 10	Dec. 1
1907	Maple	May 5	June 8	Oct. 3	Nov. 1	Nov. 3
	Elm	May 10	June 8	Oct. 6	Nov. 1	Nov. 3
	Oak	May 20	June 25	Oct. 11	Nov. 25	Nov. 30

FARMLAND, RANDOLPH COUNTY.

YEAR.	SPECIES.	First Leaves.	Woods Green.	Leaves Coloring.	Leaves Falling.	Woods Bare.
1904	Maple			Oct. 1	Oct. 15	Nov. 15
1905	Maple	Apr. 20				
	Elm	Apr. 20				
	Oak	May 6				

VEVAY, SWITZERLAND COUNTY.

1905	Maple	Apr. 14	May 10	Oct. 16	Oct. 20	
	Elm	Apr. 20				

MARENGO, CRAWFORD COUNTY.

1905	Maple	Mar. 25	May 6			
	Elm	Mar. 30	May 6			
	Oak	Apr. 21	May 6			

SHELBYVILLE, SHELBY COUNTY.

1905	Maple	Mar. 20	Apr. 10	Sept. 25	Oct. 10	
	Elm	Apr. 22	May 1			
	Oak	May 1	May 12			

EMINENCE, MORGAN COUNTY.

1907	Maple	Mar. 27	May 25	Oct. 20	Nov. 10	Dec. 1
	Elm	Mar. 27	May 25	Oct. 20	Nov. 10	Dec. 1
	Oak	Apr. 18	May 25			

MAUZY, RUSH COUNTY.

1904	Maple	Apr. 29	May 20	Oct. 10	Oct. 28	Nov. 25
	Elm	May 2	May 20			
	Oak	May 14	May 20			

V. H. CHURCH,
Section Director.

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Forest Fire Laws of Indiana.

(H. 246. Approved February 27, 1905.)

Forestry—Setting Fire to Woods—Penalty—Prosecution.

Section 1. Be it enacted by the General Assembly of the State of Indiana, That any person who shall set fire to any woods belonging to another or shall place a fire on his property and permit it to spread to the woods of another shall be liable to a fine of not less than $5.00 or more than $50.00, and furthermore shall be liable to the owner or owners for the full damages sustained by reason thereof, and it shall be the duty of the prosecuting attorney of the county to faithfully investigate and prosecute each and every case, and any failure to do so by him shall be sufficient evidence for his removal from office, and his bondsmen shall become liable for the full damages hereof sustained.

Road Supervisor—Duty as to Fire.

Sec. 2. It shall be the duty of the township road supervisor when any woods, as in Section 1, shall become on fire in his road district to employ such help as he may need to extinguish such fire, and himself and such help as he employs shall be paid by the township trustee from the general expense funds of the township at the rate of $1.50 per day for the time actually occupied in extinguishing such fire.

Burning Woods, Prairies, Etc.

Sec. 372. Whoever maliciously or wantonly sets fire to any woods, or to anything growing or being upon any marsh, prairie or grounds not his own property, or maliciously or wantonly permits any fire to pass from his own marsh, prairie or grounds, to the injury or destruction of the property of any other person, shall on conviction be fined not less than five dollars and not more than one hundred dollars, to which may be added imprisonment in the county jail not exceeding thirty days.

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